535/2
PHYSICS
Paper 2
Nov. / Dec. 1987
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

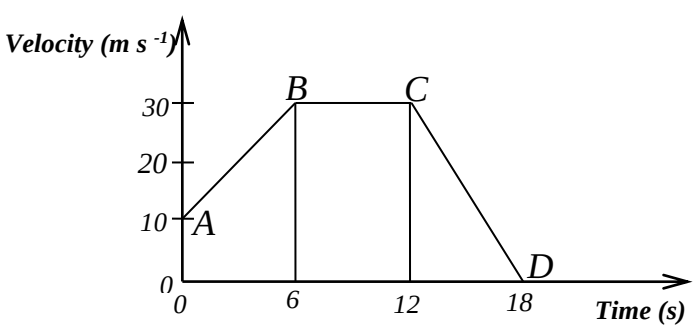
Mathematical tables and slide rules may be used.

Electronic calculators maybe used.

These following values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} $^{o}C^{-1}$
Speed of sound in air	=	330 m s^{-1}
Density of water	=	1000 kg m^{-3}

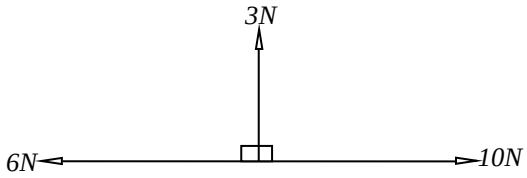
1. (a)



The diagram above represents a velocity-time graph of a body in motion.

(i) Describe the motion of the body. (*04 marks*)
(ii) Calculate the total distance travelled. (*06 marks*)

(b)



Forces of 3N, 6N and 10N act on a body of mass 2 kg, initially at rest. Find the magnitude of the acceleration with which the body moves. (*06 marks*)

2. (a) (i) Define pressure and state its unit. (*02 marks*)
(ii) Describe an experiment to show that pressure in a liquid increases with depth. (*04 marks*)
(iii) Find the length of the mercury column in a simple barometer when the barometer is raised from sea level to a height of 2.5 km given that the average density of air is 1.2 kg m^{-3} and the density of mercury is 1.36 kg m^{-3}. *(Atmospheric pressure at sea level is 76 cm of mercury).* *(04 marks)*

(b) A spring balance reads 2.42 N when a metal cube of side 3.0 cm is suspended in air from the spring balance.

(i) Find the density of the metal. *(03 marks)*
(ii) What will the spring balance read when the metal is completely submerged in a liquid of density 1200 kg m^{-3}? *(03 marks)*

3. (a) (i) Draw a labeled diagram to show the essential parts of a d.c motor. *(03 marks)*
(ii) Describe briefly how a d.c motor works. *(03 marks)*

(b) An electric motor of efficiency 90 % operates a water pump. The pump raises 0.9 kg of water through a distance of 10 m every second.

(i) What is meant by the term efficiency? *(01 mark)*
(ii) State the energy changes which take place. *(03 marks)*
(iii) Find the electrical power supplied to the motor. *(06 marks)*

4. (a) Use the kinetic theory of matter to explain the following:

(i) the valve of a bicycle tyre warms up on pumping. *(03 marks)*
(ii) water in a porous clay pot keeps at a lower temperature than that of the surroundings. *(03 marks)*
(iii) the change of state from solid to liquid. *(03 marks)*

(b) An empty bottle is corked when air inside is at 150 ^{o}C and at standard atmospheric pressure. Calculate the temperature to which the air must be heated for the cork to blow out, if it is able to blow out when the pressure of the air exceeds 1.3 times the standard atmospheric pressure. *State the assumptions you have made.* *(07 marks)*

5. (a) Describe the composition of the $^{23}_{11}Na$ atom. *(03 marks)*

(b) A radioactive nuclide emits an alpha particle and turns into another nuclide Y.

(i) Write a balanced equation to represent this nuclear charge. *(03 marks)*

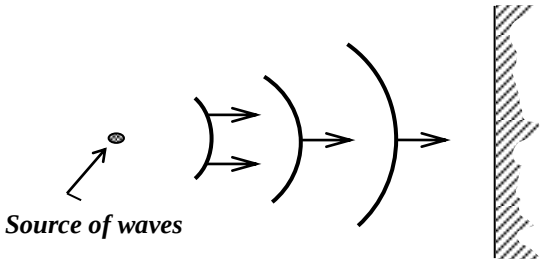
(ii) How would the nuclide X be affected if a beta particle was emitted instead of an alpha particle. *(02 marks)*

(iii) Compare the nature of and properties of an alpha particle with those of a beta particle *(04 marks)*

(c) Describe briefly how X-rays are produced. *(Diagram of the X-ray tube is not required)*. *(04 marks)*

6. (a) List three differences and three similarities between sound waves and light waves. *(06 marks)*

(b)



The above diagram shows circular waves propagating towards a plane reflector.

(i) Draw a diagram to show how the waves will be reflected. *(02 marks)*

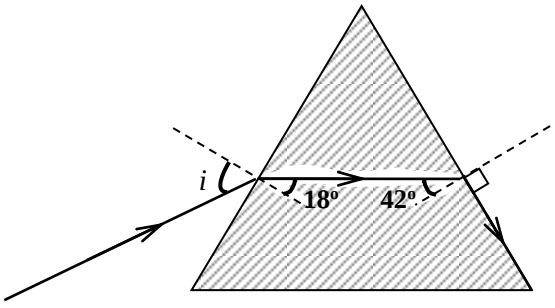
(ii) Calculate the frequency of the waves if their velocity and wavelength are 5.0 m s $^{-1}$ and 0.5 m respectively. *(03 marks)*

(c) A man standing midway between two cliffs makes a loud sound. He hears the first echo after 3 s. Calculate the distance between the two cliffs. *(05 marks)*

7. (a) Describe a simple method of measuring the refractive index of glass in form of a glass block. *(06 marks)*

(b) (i) Explain, with the aid of a diagram, the term critical angle. *(04 marks)*

(ii) Light of the same wavelength is incident at an angle, *I*, on a glass prism. The light is refracted and follows the path shown in the figure below.



Find the angle of incidence, *i*. *(06 marks)*

8. (a) Give the advantages of alternating current over direct current in power transmission. *(02 marks)*

(b) Describe with the aid of a diagram, the construction and action of a transformer. *(05 marks)*

(c) A transformer is designed to operate at 240V mains supply and delivery 9V. The current drawn from the mains supply is 1.0 A. If the efficiency of the transformer is 90%, calculate the

(i) maximum output current. *(04 marks)*
(ii) power loss. *(03 marks)*

(d) State the possible causes of the power loss in (c) (ii) above. *(02 marks)*

END

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Electronic calculators maybe used.

These following values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4.2 $x10^3$ J $kg^{-1}{}^oC^{-1}$
Speed of sound in air	=	330 m s^{-1}
Density of water	=	1000 kg m^{-3}
Specific heat capacity of ice	=	2.1 $x10^3$ J kg^{-1} K^{-1}.
Specific latent heat of fusion of water	=	2.26 $x10^6$ J kg^{-1}
Specific latent heat of fusion of water	=	3.36 $x10^5$ J kg^{-1}

1. (a) (i) Describe an experiment to estimate the thickness of an oil molecule.
(ii) What assumptions are made in the experiment described in (a) (i) above

(b) When a thin capillary tube is dipped in a basin of water, the water level in the tube rises.

(i) Explain why this happens.
(ii) Name one practical application of this effect.

2. (a) Describe with the aid of a diagram, the structure and principle of operation of a transformer.

(b) An electric power generator produces 24 kW at 240*V* a.c. The voltage is stepped up to 4000*V* for transmission to a factory, where it is then stepped down to 240*V*. The total resistance of the transmission wires is 0.5Ω.

(i) What is the ratio of the number of turns in the primary coil to the number of turns in the secondary coil of the step-down transformer?
(ii) Find the power lost in the transmission lines assuming both transformers are 100% efficient.
(iii) What power would have been lost if the same electric had been transmitted directly to the factory through the same transmission wires without use of transformers?
(iv) Comment on the difference between the power losses in (ii) and (iii) above.

3. (a) Define the following terms:

(i) atomic number.
(ii) mass number.
(iii) isotopes.

(b) A radioactive nucleus decays by emission of alpha particles.

(i) What are alpha particles?
(ii) What changes occur in mass number and atomic number when the alpha particle is emitted?
(iii) State any three differences between alpha particles and beta particles.

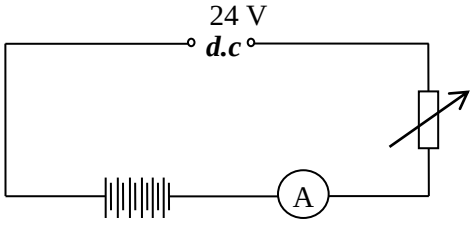
(c) The table shows the count rates of a certain radioactive material.

Count rate (s^{-1})	6400	5380	3810	2700	1910	1350
Time (min)	0	1	3	4	7	9

Plot a graph and use it to find the half-life of the material.

4. (a) (i) What is meant by the e.m.f of a source of electrical energy?
(ii) Draw a labeled diagram to show the structure of a dry cell.

(b)



Six accumulators each of e.m.f, 2*V* and each of internal resistance 0.1Ω are charged from a 24*V*d.c. supply as shown above.

(i) Explain why it is necessary to include a rheostat in the circuit.
(ii) What will the ammeter read if the rheostat is set at 5.4Ω?

(iii) Find the rate at which electrical energy is converted to chemical energy in (ii) above.

5. (a) Describe an experiment to determine the specific latent heat of fusion of ice.

(b) Two kilograms of ice initially at -10 ^{0}C is heated until it changes to steam at 100 ^{0}C.

(i) Sketch a graph to show how the temperature changes with time.
(ii) Calculate the thermal energy required at each end of the graph.

6. (a) State the laws of reflection of light.

(b) With the help of ray diagrams,

(i) explain the action of a pin-hole camera.
(ii) distinguish between partial and total eclipses of the moon.

(c) (i) Describe a simple experiment to determine the focal length of a concave mirror.
(ii) State and explain one application of a convex mirror.

7. (a) State the factors which determine the magnitude of the e.m.f induced in a conductor cutting at right angles across a magnetic field.

(b) (i) Describe with the aid of a labeled diagram, the structure and action of a simple a.c. generator (alternator).
(ii) Sketch the variation with time of the e.m.f generated by a simple a.c. generator.
(iii) Use the sketch in (ii) above to explain the terms peak value and frequency of an alternating e.m.f.

8. (a) Give the differences between transverse and longitudinal waves.

(b) Two identical sources are made to produce circular waves in a ripple tank.

(i) Explain with the aid of a diagram, how interference fringes may be obtained.
(ii) What happens when the distance between the sources is reduced?

(c) A vibrator of frequency 50 Hz produces circular waves in a ripple tank. If the distance between consecutive crests is 3 cm, what is the speed of the waves?

(d) (i) Explain why echoes are not heard in a small room.
(ii) Describe a simple echo method of determining the speed of sound in air.

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Attempt any **five** *questions.*

Mathematical tables and slide rules may be used.

Electronic calculators maybe used.

These following values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Density of water	=	1000 kg m^{-3}

1. (a) (i) Define the term velocity.
(ii) Sketch a velocity-time graph for a body moving uniform velocity.

(b) A vehicle travelling at a velocity of 90 km h^{-1}, is uniformly brought to rest in 20 s.

(i) Calculate the acceleration of the vehicle.
(ii) If the vehicle had originally been travelling at the velocity of 80 km h^{-1} for 60 s, calculate the total distance travelled before it finally stopped.

(c) An inflated balloon is stationary air. Explain what happens when the air is allowed to escape from the nozzle.

2. (a) (i) What is meant by a ductile material?
(ii) What properties would you look for when selecting a material for overhead cables?

(b) (i) State the advantages of glass as a construction material.
(ii) Explain briefly how concrete may be improved so as to withstand tensional forces.
(iii) Explain how a plank of wood with cracks on one side may be placed to form a single bridge instead of solid ones. What advantages do such structures have?
(iv) In the construction of bridges or large structures, hollow tubes of strong metals are used instead of solid ones. What advantages do such structures have?

3. (a) State the principle of moments.

(b) A uniform beam is pivoted at its centre.

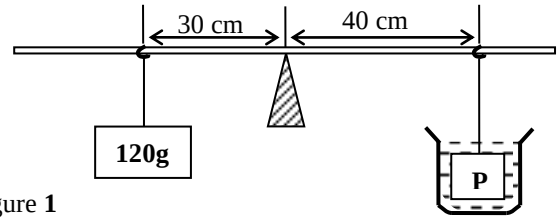

Figure **1**

A mass of 120 g is suspended at 30 cm from the centre of the beam. The beam remains horizontal when a block P suspended at 40 cm from the centre of the beam is immersed in a liquid of density 800 kg m^{-3} as show in figure **1**. If the volume of the liquid displaced is 10 cm^{3}, find

(i) the mass of the liquid displaced.
(ii) the weight of P in air.

(c)

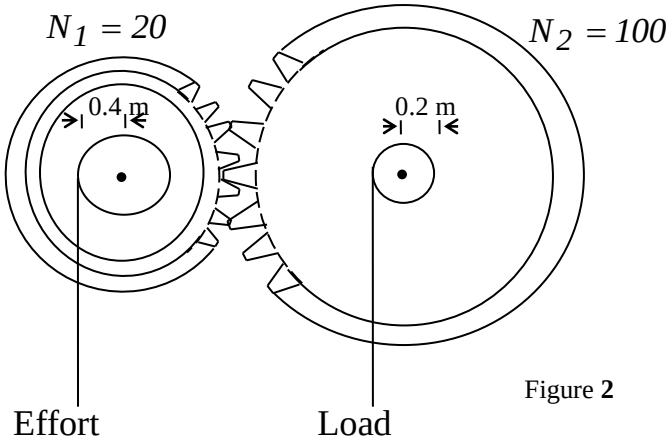

Figure **2**

In the gear system sketched in figure **2**, N_1 and N_2 are the number of teeth on the wheels. If the shaft radii are 0.4 m and 0.2 m respectively and the efficiency is 30%, find

(i) the velocity ratio.
(ii) the load that can be raised by an effort of 200 N

4. (a) (i) Explain the term total internal reflection.
(ii) Calculate the critical angle for a glass-air boundary if the refractive index of the glass is 1.60.

(b) With the aid of a diagram, explain the dispersion of white light by a glass prism.
(c) Explain the appearance of a blue flag with red stripes when viewed in day light through a sheet of yellow glass.

5. (a) Sketch the electric field patterns for the following:

(i) two negative point charges close to each other.
(ii) a positively charged hollow conducting sphere.
(iii) two oppositely charged parallel plates.

(b) Explain the following observations.

(i) The leaves of a positively charged electroscope fall when the cap is touched by a finger.
(ii) When a positively charged conductor is lowered in an ice-pail placed on the cap of an uncharged electroscope, the leaves diverge. When the conductor touches the inside of the pail, the divergence of the leaves is not altered; but when the conductor is removed and tested, it shows no charge.

(c) Explain how a lightning conductor safe-guards a house against lightning.

6. (a) Figure **3** shows the diagram of a cross-section of a ripple tank in which A is a straight dipper and B is a barrier with two gaps. Sketch a diagram showing waves produced when A vibrates perpendicularly to the water surface.

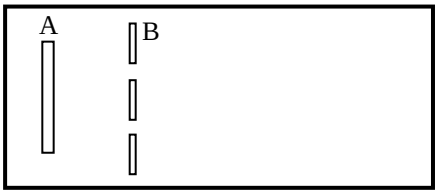

Figure **3**

Copy and draw the diagram to show the waves after passing through the two gaps.

(b) What happens when

(i) the gaps are narrower?
(ii) the separation of the gaps is increased?
(iii) the frequency of vibration of A is increased?

(c) If A vibrates with a frequency of 20 Hz and is 25 cm from B, find

(i) the speed of the wave if a wave front takes 5 s from A to B.
(ii) the wavelength of the waves.

(d) State two differences between water waves and light waves.

7. (a) Define the following terms.

(i) A volt.
(ii) Electric resistance.

(b) A battery of e.m.f 20*V* and of negligible internal resistance is connected as shown in figure **4** Find the reading of the ammeter A.

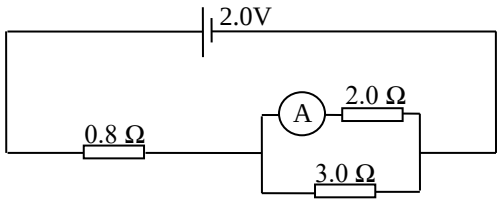

Figure **4**

(c) A battery of e.m.f 12*V* and internal resistance 1 **Ω** is connected for 3 minutes 2 seconds a cross a heating coil of resistance 11 **Ω** immerse in a liquid of mass 0.2 kg and specific heat capacity 2.0×10^3 J kg $^{-1}$ K $^{-1}$. Find the rise in temperature of the liquid. ***(****State clearly the assumptions made).*

8. (a) Explain the following terms as applied to a thin converging lens

(i) Principal focus.
(ii) Focal length.
(iii) Power.

(b) An object is placed at right angles to the principal axis of a thin converging lens of focal length 10 cm. An image of height 5 cm is formed 30 cm from the lens. Find, by construction the position and height of the object.

(c) With the help of a ray diagram, show how a converging lens can be used as a magnifying glass.

END

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Density of water	=	*1000 kg m $^{-3}$*

Turn Over

1. (a) State the differences between mass and weight.

(b) A man of mass 80 kg stands in a stationary lift on earth. Calculate his apparent weight when the lift

(i) accelerates upwards at a rate of 2 m s^{-2}.
(ii) falls freely under gravity.

(c) A body is fired horizontally with a speed of 30 m s^{-1} from a cliff 500 m above the ground. Calculate

(i) the time taken before the body hits the ground.
(ii) the horizontal distance travelled.

2. (a) A radioactive nuclide $^{226}_{88}Ra$ decays by emission of two alpha particles and two beta particles to a nuclide Y.

(i) What is meant by a radioactive nuclide?
(ii) Give three differences between alpha and beta particles.
(iii) State the atomic number and mass number of Y.

(b) What precautions would have to be taken when handling radioactive materials?

(c) A certain mass of a radioactive material contains 2.7 x 10^{24} radioactive atoms. How many atoms will have decayed after 3200 years if the half-life of the material is 1600 years?

(d) Explain briefly one industrial application of radioactivity.

3. (a) Name one instrument that turns

(i) Chemical energy to electrical energy.
(ii) Heat energy to electrical energy.

(b) With the help of a well labeled diagram, describe how a simple dynamo generates an electromotive force (e.m.f).

(c)

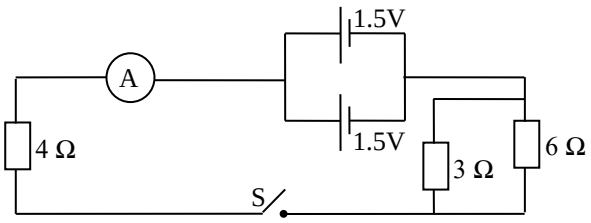

Figure **1**

Figure **1** shows two cells, each of internal resistance 1 **Ω** connected to a circuit in which includes switch S.

(i) What is the reading of the ammeter when switch S is closed?
(ii) Calculate the developed in the 4 **Ω** resistor when switch S is closed.

4. (a) Describe a simple experiment to determine the refractive index of the glass of a triangular prism.

(b) The angle of refraction in a glass block is 32^0. Calculate the angle of incidence if the refractive index of the glass is 1.5.

(c) A simple magnifying glass of focal length 5 cm, forms an erect image, of a small object, 25 cm from the lens.

(i) By graphical method, find the distance between the object and the image.
(ii) Calculate the magnification.

5. (a) State

(i) Archimedes principle.
(ii) the law of floatation.

(b) When a metal is completely immersed in liquid A, its apparent weight is 20 N. When it is immersed in another liquid B, the apparent weight is 16 N. If the density of B is $9/8$ times that of A, calculate the mass of the metal.

(c) (i) What is meant by the terms surface tension and diffusion?
(ii) Describe an experiment to demonstrate diffusion in liquids.
(iii) State two ways by which the surface tension of water can be reduced.

6. (a) Distinguish between longitudinal waves and transverse waves. Give one example of each.

(b) Describe an experiment to show interference of water waves.

(c) (i) What are the conditions for the formation of standing waves.
(ii) Name two instruments where standing waves are applied.

(d) Describe the resonance method of determining the speed of sound in air.

(e) A fork has a frequency of 256 Hz. Assuming the speed of sound in air is 320 m s^{-1}, calculate the wavelength of the sound note given by the fork.

7. (a) Use the kinetic theory to explain the following observations:

(i) Ice melts faster when salt is sprinkled on it.
(ii) The pressure of a fixed mass of a gas at constant volume increase when the temperature increases.
(iii) Liquids expand more than equal volumes of solids when heated through the same temperature.

(b) A drop of olive oil of volume 0.1 mm^3 is placed on the surface of clean water. It spreads out completely into a patch of area 100 cm^2.

(i) Calculate the thickness of the oil patch.
(ii) Estimate the number of molecules in 0.1 mm^3 of the oil. *State the assumptions made.*

8. (a) Draw a labeled diagram of a gold-leaf electroscope.

(b) Describe an experiment to test the charge on a charged body using a gold leaf electroscope.

(c) Draw the electric field pattern for

(i) two positively charged bodies a small distance apart.
(ii) an isolated negative charge.
(iii) two parallel plates with opposite charges at a small distance apart.

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Specific heat capacity of water	=	*4200 J kg $^{-1}$°C $^{-1}$*
Density of water	=	*1000 kg m $^{-3}$*

1. (a) (i) What is meant by the terms *scalar* and *vector* quantities? Give two examples of each.

(ii) State the condition under which a body is said to be in *mechanical equilibrium*.

(iii)

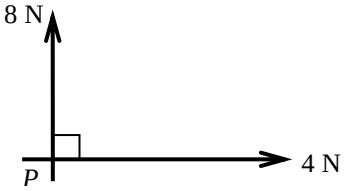


Figure **1**

Two forces of 8 N and 4 N act on a body at P as shown in figure **1**. Find the magnitude of the third force to keep the body in equilibrium.

(b) What is meant by *kinetic energy* and *potential energy*?

(c)

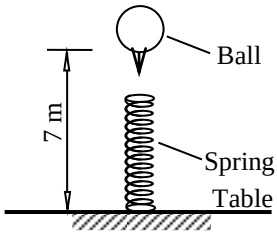


Figure **2**

A ball of mass 100 g falls from rest through a height of 2 m onto the top of a spring of length 1m, placed on a table as shown in figure **2**.

(i) How much energy is passed onto the spring by the ball?
(ii) If the elastic constant of the spring is 100 N m^{-1}, what will be the compression of the spring?

2. (a) (i) State the principle of moments.
(ii) Describe how the principle of moments can be verified experimentally.
(iii) State two practical applications of the principle of moments.

(b) Two labourers **A** and **B** carry between them a load of weight 500 N on a uniform pole of weight 50 N. If the poleis 2 m long and the load is 50 cm from **A** towards **B**,

(i) draw a diagram to show the forces acting on the pole.
(ii) find the fraction of the total weight that I supported by **B**.

3. (a)

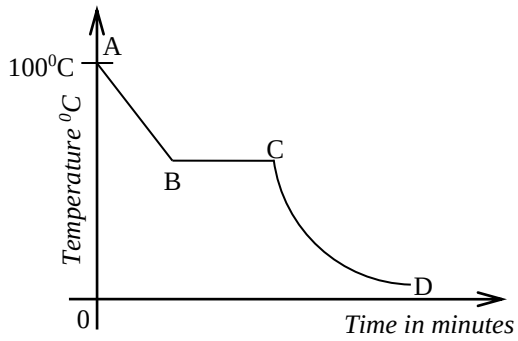


Figure **3**

Figure **3** shows a cooling curve for a substance which is liquid form at 100 ^{0}C.

(i) In what states is the substance over the regions AB, BC, and CD of the curve?
(ii) Use the kinetic of matter to explain the difference between the states of substance over the regions AB and CD.

(b) (i) Define *specific heat capacity.*

(ii) The same amount of heat which raises the temperature of 0.1 kg of water from 25 ^{0}C to 60 ^{0}C is used to heat a metal rod of mass 1.7 kg and specific heat capacity 300 J kg $^{-1}$ K $^{-1}$. If the original temperature of the rod is 20 ^{0}C, calculate the final temperature of the rod.

(c) (i) What is *saturated vapour*?

(ii) Explain why the boiling point of a liquid depends on the altitude.

4. (a) (i) Describe a simple experiment to show that light travels in a straight line.

(ii) An object 3 cm high is placed at right angles to the principal axis of a concave mirror of focal length 7.5 cm. If the object is 30 cm from the pole of the mirror, construct a ray diagram to obtain the position and size of the image formed.

(iii) State two applications of a concave mirror.

(b) (i) State the laws of reflection of light.

(ii) Light of the same wavelength is incident from air on glass of refractive index 1.5. If the angle of incidence is 60^0, find the angle of refraction.

5 (a) (i) Describe an experiment to determine the velocity of sound in air.

(ii) What factors would affect the value of the velocity of sound obtained from the experiment in (i) above?

(b) Explain why a musical note played on a piano sounds different from that played on a guitar.

(c) (i) Calculate the wavelength of a sound wave of frequency 3.3 kHz and speed 330 m s $^{-1}$.

(ii) State four differences between sound and radio waves.

6. (a) (i) What are the advantages of a.c over d.c in mains supply?

(ii) State the safety precautions which must be taken when wiring a house.

(b) (i) What is the meaning of a *kilowatt hour*(kWh)?

(ii) A house has one 100 W bulb, two 75 W bulbs and five 40 W bulbs. Find the cost of having these bulbs switched on for 2 hours every day for 30 days at a cost of Shs. 20/= per unit.

7. (a) State the law of electrostatics.

(b) Describe how two identical metal balls may be charged positively and simultaneously by induction.

(c) Draw a labeled diagram of a gold leaf electroscope.

(d) (i) Explain what happens when a negatively charged rod is brought near the cap of an uncharged electroscope and slowly taken away.

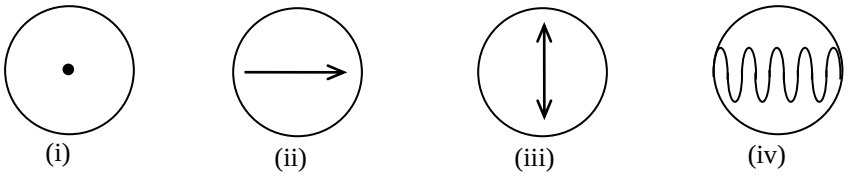
(ii) How can an electroscope be used to test whether a material is a conductor or an insulator.

(e) What precautions should be taken when carrying out experiments in electrostatics?

8. (a) (i) Draw a labeled diagram of a cathode ray oscilloscope (CRO)

(ii) State one function of each of the parts you have labeled in (i) above

(b)



(i) (ii) (iii) (iv)

Figure **4**

The diagrams in figure **4** show the traces of a cathode ray beam on the screen of the cathode ray tube. Explain how each one may be obtained.

(c) Give two uses of a CRO.

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2 1/4 hours

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PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

Mathematical tables, slide rules and non-programmable electronic calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 $m\ s^{-2}$
Specific heat capacity of water	=	4200 $J\ kg^{-1}K^{-1}$
Speed of light	=	$3.0 \times 10^{8}\ m\ s^{-1}$
Density of water	=	1000 $kg\ m^{-3}$
Specific latent heat of fusion of water	=	$3.36 \times 10^{5}\ J\ kg^{-1}$

1. (a) (i) What is a *magnetic field*?
(ii) Draw a diagram of the magnetic field pattern between the north poles of two bar magnets placed near each other.

(b) Describe how you can plot the magnetic field around a wire carrying a current perpendicular to the plane of the paper.

(c) Draw a diagram to show what happens when two straight conductors placed vertically near each other carry a current in

(i) the same direction
(ii) opposite direction.

(d) Describe briefly two methods of magnetizing an iron rod.

(e) A transformer is designed to produce an output of 220*V* when connected to a 25*V* supply. If the transformer is 80% efficient, calculate the input current when the output is connected to a *220V, 75 W* lamp

2. (a) Sketch the current and p.d variation for a semi-conductor diode.

(b)

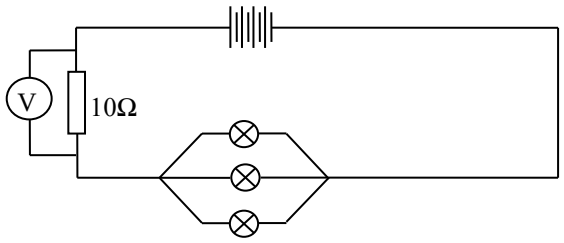

Figure **1**

Four identical cells each of internal resistance 0.2Ω are connected to form a battery. Three identical lamps each marked 3 W and a10Ω resistor are connected to the battery as shown in figure **1**. If the current through each lamp is 0.5*A*, find

(i) the resistance of each lamp.
(ii) the reading of the voltmeter, V.
(iii) the effective resistance in the circuit.
(iv) the energy delivered by the battery per second.

(c) Calculate the cost of running an electric fire for $2^1/_2$ hours if the electric fire takes a current of 13*A* on a 100*V* supply and each unit costs Shs. 40/=.

3. (a) (i) What is meant by *acceleration due to gravity*?
(ii) Describe a simple experiment to determine acceleration due to gravity.

(b) A 5 kg mass is dropped from a height above the ground and hits the ground after 4.5 s.

(i) Find the velocity of the mass as it hits the ground.
(ii) Calculate the kinetic energy of the mass just before it hits the ground.
(iii) From what height was the mass dropped?
(iv) State the energy changes of the mass.

4. (a) Give two methods of producing electrons from metals

(b) State the effect of each of the following on a fine beam of electrons.

(i) electric field.
(ii) magnetic field.

(c) (i) Explain briefly how X-rays are produced.
(ii) Distinguish between hard X-rays and soft X-rays.
(iii) What precautions should be taken to minimize health hazards?

5. (a) (i) State the laws of reflection.
(ii) Describe an experiment to verify the laws of reflection.

(b)

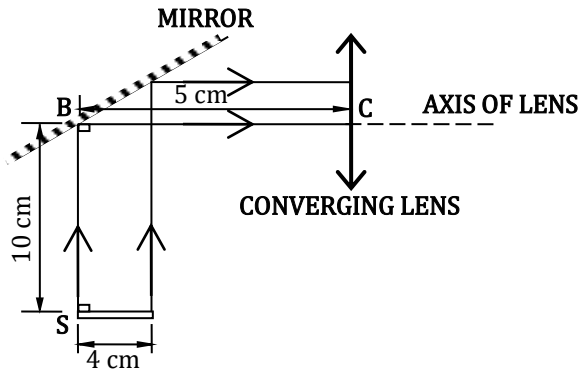

Figure **2**

Figure **2** shows a stick, S lying on a horizontal ground. Two parallel rays from the stick strike the mirror and are reflected on to the converging lens whose centre is C. The focal length of the lens is 10 cm and the distances SB and BC are 10 cm and 5 cm respectively.

(i) State the nature of the image of the stick formed by the lens.
(ii) Use graphical method to locate the positions of the two images of the stick.
(iii) Find the magnification of the final image.

6. (a) State what is meant by each of the following as to simple machines;

(i) mechanical advantage.
(ii) efficiency.

(b) (i) Give two reasons why the efficiency of any practical machine is always less than 100%.
(ii) State two ways by which the efficiency of a machine may be increased.

(c)

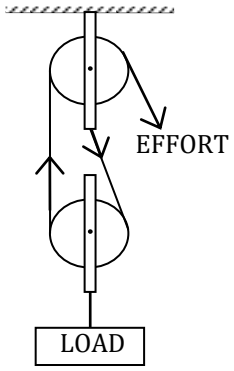

Figure **3**

Figure **3** shows a load of 10 N being raised by the aid of a simple frictionless pulley system.

(i) What is the velocity ratio of the system?
(ii) Calculate the effort required to raise the load if the mass of each pulley is 0.2 kg.
(iii) If the load is raised through a distance of 5 m in 5 s, calculate the efficiency of the system.

7 (a) Define each of the following terms as applied to wave motion;

(i) wave front.
(ii) wavelength.

(b) The wavelength of a radio wave is 10 m. Calculate

(i) the frequency.
(ii) the period of the wave.

(c) Why does sound travel faster in solids than in gases?

(d) (i) Explain why an open pipe is preferred to a closed pipe when used in producing different notes.

(ii) The frequency of the third harmonic in a closed pipe is 280 Hz. Find the length of the air column in the pipe.

8. (a) (i) Define *specific latent heat of fusion of a solid*.

(ii) Describe a simple experiment to determine the specific latent heat of fusion of ice. State any precautions taken.

(b) Use the kinetic theory to explain the occurrence of latent heat of fusion.

(c) An ice-making machine removes heat from water at a rate of 20 J s^{-1}. How long will it take to convert 0.5 kg of water at 20 ^{0}C to ice at 0 ^{0}C?

END

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INSTRUCTIONS TO CANDIDATES:

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Mathematical tables, slide and non-programmable electronic calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	$10 m s^{-2}$
Specific heat capacity of water	=	$4200 J kg^{-1} K^{-1}$
Specific heat capacity of copper	=	$400 J kg^{-1} K^{-1}$
Speed of light	=	$10^8 m s^{-1}$
Density of water	=	$1000 kg m^{-3}$

1. (a) Define *pressure*.

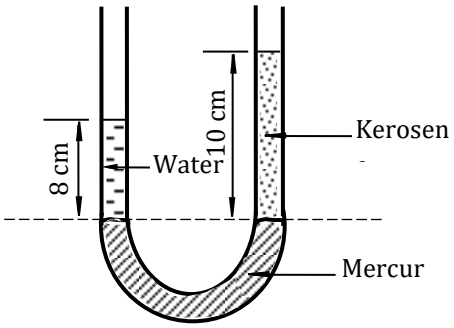

Figure **1**

An open U-tube contains columns of water and kerosene over mercury as shown in figure **1**.

Calculate the density of kerosene.

(b) State two factors on which the pressure in liquids depends.
Explain why cooking at a high altitude takes a longer time than at a lower altitude.

(c) With the aid of a labeled diagram, describe how a force pump works.

2. (a) (i) Name the particles emitted by radioactive nuclides.
(ii) Give one property common to the particles named in (i).

(b)

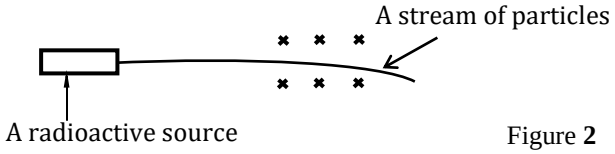

Figure **2**

A stream of particles from a radioactive source passes through a magnetic field directed into a plane of the paper as shown in figure **2**.

(i) Identify the particles in the stream.
(ii) Sketch a diagram to show the path of the particles in an electric field.

(c) (i) Define *half -life*.
(ii) *x* grams of a radioactive material of half- life of 3 weeks, decay and 5.12 g remains after 15 weeks.
Determine the value of *x*.

(d) Distinguish between the terms *fusion* and *fission*.
State two conditions necessary for each to occur.

3. (a) With the aid of labeled diagram, describe an experiment to show the relationship between the volume and temperature of a fixed mass of a gas at atmospheric pressure.

(b) A cylinder with a movable piston contains 0.1 m^3 of air at a temperature of 27 ^{0}C.
Calculate the volume of the gas if it is cooled to – 73 ^{0}C at constant pressure.

(c) Define the term *specific heat capacity*.

(d) A copper block of mass 250 g is heated to a temperature of 145 ^{0}C and then dropped into a copper calorimeter of mass 250 g which contains 250 cm^3 of water at 20 ^{0}C.

(i) Calculate the maximum temperature attained by the water.
(ii) Sketch a graph to show the variation of the temperature of water with time.

4. (a) Explain the difference between *transverse* and *longitudinal waves*.
Give one example of each.

(b)

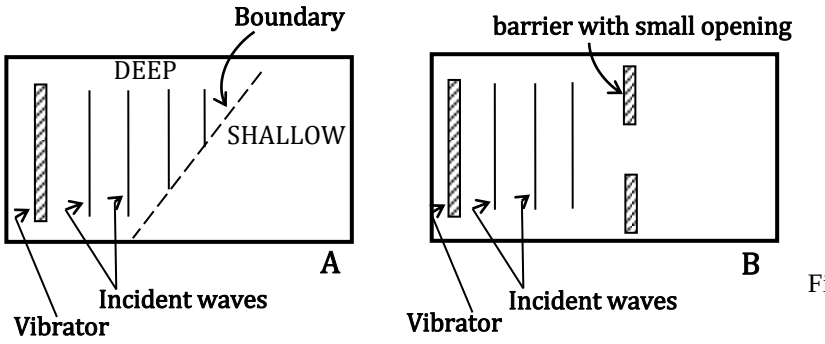

Figure **3**

The diagrams in figure **3** represent a plane view of horizontal ripple tanks set up to study the characteristics of water waves. The vibrators were set up to produce plane waves.

(i) Draw diagrams to show the wave patterns expected in **A** and **B**
(ii) Explain what happens to the plane waves in each case.

(c) A vibrator in a ripple tank vibrates at 5 Hz. If the distance between 10 successive crests is 37.8 cm. Calculate

(i) the wavelength of the waves.
(ii) the velocity of the waves.

5. (a) What is meant by *uniform acceleration*.

(b) A body of mass 60 kg starts moving with a velocity of 15 m s $^{-1}$ and accelerates uniformly at a rate of 4 m s $^{-2}$ for 5 s, then maintains a constant velocity for another 5 s and comes to rest after 7 s.

(i) Draw a velocity-time graph for the motion.
(ii) Calculate the momentum of the body during the eighth second.
(iii) Calculate the retarding force.

(c)

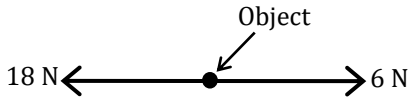

Figure **4**

Two forces of 18 N and 6 N act in opposite directions on an object of mass 3 kg as shown in figure **4**. Calculate the acceleration of the body.

6. (a) (i) Draw a diagram to show the structure of a simple cell.
(ii) Give one defect of a simple cell and state how it is minimized.

(b) Explain how a lead acid accumulator can be recharged when it runs down.

(c)

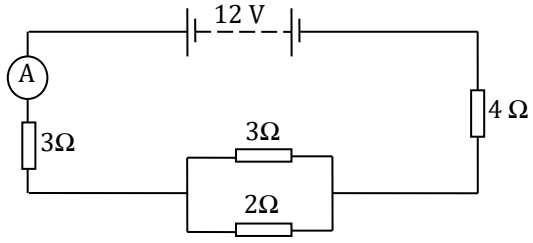

Figure **5**

Four resistors are connected across a 12*V* battery, of negligible internal resistance as shown in figure **5**. Determine

(i) the reading of the ammeter A.
(ii) the p.d across the parallel combination of resistors.

(d) When two identical heating elements of a kettle are connected in series to a 240*V* supply, the power developed is 400 W. Find

(i) the resistance of either element.
(ii) the power developed when the elements are connected in parallel to the same supply.

7. (a) Define

(i) the principal focus of a converging lens.
(ii) a virtual image.

(b) With the aid of a labeled diagram, describe a simple experiment to determine the focal length of a converging lens.

(c) An object of height 4 cm is placed perpendicularly on the principal axis at a distance of 45 cm from a converging lens of focal length of 15 cm. By graphical construction determine

(i) The position of the image.
(ii) The magnification.

(d) Give one use of converging lenses.

8. (a)

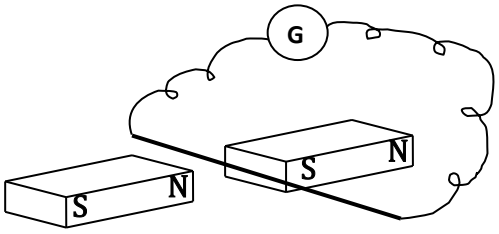

Figure **6**

A wire placed between the poles of two permanent magnets is connected a galvanometer G as shown in figure **6**.

(i) State what is observed when the wire is moved up and down.
(ii) Suggest two ways of altering the magnitude of the effect you have stated in (i).

(b) Explain briefly what is meant by *mutual induction*.

(c) (i) Mention the causes of energy loss in a transformer and state how the loss can be minimized.
(ii) A transformer has 200 turns on the primary coil. Calculate the number of turns of the secondary coil if 240*V* is to be stepped to 415*V*.

END

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2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

Mathematical tables, slide and non programmable electronic calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	$10 m s^{-2}$
Specific heat capacity of water	=	$4200 J kg^{-1} K^{-1}$
Speed of light	=	$3 \times 10^{8} m s^{-1}$

1. (a) Differentiate between *conduction* and *convection*.

   (b) Describe an experiment which can be performed to show convection in liquids.

   (c) (i) Draw a labeled diagram of a vacuum flask.
   (ii) Explain how a vacuum flask minimizes heat loses.

   (d) Why is a car radiator made of fins and painted black?

2. (a) State three factors on which the magnitude of a force exerted on a wire carrying a current in a magnetic field depends.

   (b) With the aid of a labeled diagram, describe the action of a moving coil loudspeaker.

   (c) A moving coil galvanometer has a coil of resistance 4 **Ω** and gives a full scale deflection when a current of 25 mA passes through it. Calculate the value of the resistance required to convert it to an ammeter which reads 15 A at full scale deflection.

3. (a) State Newton's laws of motion.

   (b) A water jet directed to a spot on the ground digs a hole in the ground after some time. Explain.

   (c) A moving ball *P* of mass 100 g collides with a stationary ball *Q* of mass 200 g. After collision, *P* moves backwards with a velocity of 2 m s^{-1} while *Q* moves forward with a velocity of 5 m s^{-1}. Calculate

   (i) the initial velocity of *P*.
   (ii) the force exerted by *P* on *Q* if the collision took 0.03 seconds.

   (d) Explain the principle of operation of a rocket engine.

4. (a) Explain the phenomenon of *dispersion* as applied to white light.

   (b) Draw a ray diagram to show dispersion of white light by a glass prism.

   (c) Distinguish between secondary and primary colours. Give one example of each.

   (d) Name the colour that would be obtained when the following coloured lights are mixed.
   (i) green and red.
   (ii) cyan and red.

   (e) Explain why an object illuminated by white light appears
   (i) coloured.
   (ii) black.

5. (a) Define the *volt*.

   (b) Draw a circuit diagram which can be used to investigate the p.d.-current relationship for a wire.

   (c) Sketch a graph of current against p.d. for
   (i) a carbon resistor.
   (ii) a semi-conductor diode.

   (d) An accumulator of e.m.f 24*V* and internal resistance of 2 **Ω** is connected to 3 **Ω**, 4 **Ω**, 2 **Ω** and 6 **Ω** resistors as shown in figure **1**.

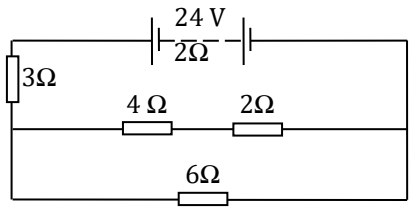

Figure **1**

Calculate

(i) the current through the 6 Ω resistor.
(ii) the total power expended.

(e) State two precautions which must be taken to protect an accumulator.

6. (a) Define the terms *atomic number* and *mass number*.

(b) When lithium is bombarded by neutrons, a nuclear reaction occurs which is represented by the following equation.

$$^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{3}_{1}H + P$$

Complete the equation and name *P*.

(c) Describe the application of radioactivity in determining the age of fossils (remains of old plants and animals).

(d) The half-life of uranium is 24 days.
Calculate the mass of uranium that remains after 120 days if the initial mass is 64 g.

(e) Give two harmful effects of radioactivity.

(f) State three differences between cathode rays and X-RAYS.

7. (a) Define the terms *strain* and *stress*.

(b) Figure **2** shows a diagram of a bicycle.

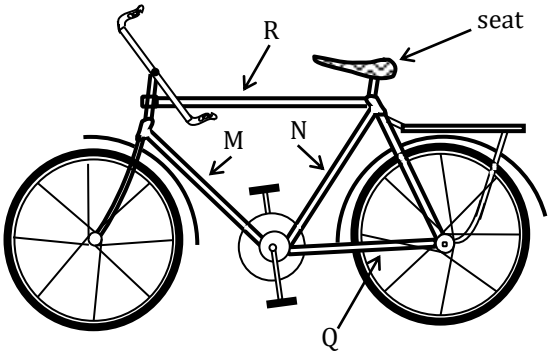

Figure **2**

Which of the parts labeled *M, N, Q* and *R,* would be

(i) in tension,
(ii) in compression when a heavy person sits on the seat?

(c) Give four reasons why bicycle frames are made of hollow cylindrical structures.

(d) Explain why the lower part of the second floor of a building is made of reinforced concrete while the upper part is not reinforced.

(e) Figure **3** shows a part of a roof structure.

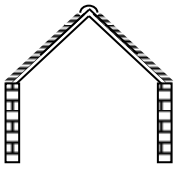

Figure **3**

(i) Copy the diagram and on it show how the structure can be strengthened by using two other girders.
(ii) Label one tie and one strut on your diagram.

8. (a) Explain each of the following observations:

(i) Sound from a distant source is louder at night than during day time.
(ii) An observer can hear sound a source which is behind a building.

(b) Describe an experiment to show interference of sound waves.

(c) A man stands between two cliffs and makes a loud sound. He hears the first echo after 1 s, and the second echo after a further 1 second. Find the distance between the cliffs.

(d) Straight water waves travel from deep to shallow water as shown in figure **4**.

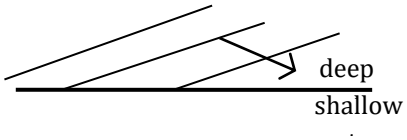

Figure **4**

Copy and complete the wave front pattern in the shallow water.

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Acceleration due gravity, g	=	10 m s^{-2}
Speed of light	=	3 $x10^{8}$ m s^{-1}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}

1. (a) Figure **1** shows the main parts of a cathode ray oscilloscope. Identify the parts labeled **U**, **V** and **X** and briefly describe their functions.

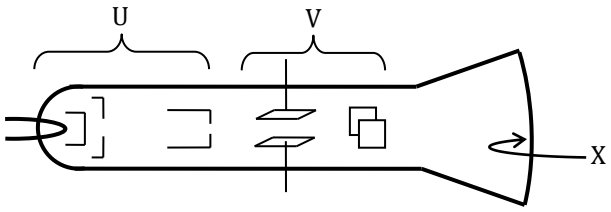


Figure **1**

(b) (i) Name the particles emitted by radioactive materials.
(ii) Draw diagrams to show the paths of the particles named in (b) (i) above in a cloud chamber.

(c) A zinc cathode was enclosed in an evacuated glass tube as shown in figure **2**.

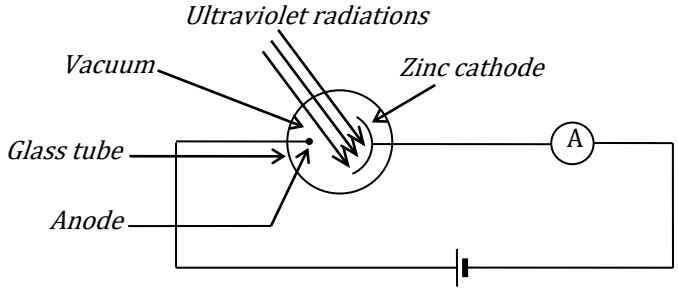


Figure **2**

When the cathode was irradiated with ultraviolet radiations, the ammeter gave a reading.

(i) Explain why the ammeter gave a reading.
(ii) A gas was gradually introduced into the glass tube. Explain what happened.

2. (a) Explain each of the following observations:

(i) An inflated bicycle tube may burst when left in a hot place.
(ii) Large water reservoirs are much wider at the base than the top.

(b) Figure **3** shows the structure of a force pump.

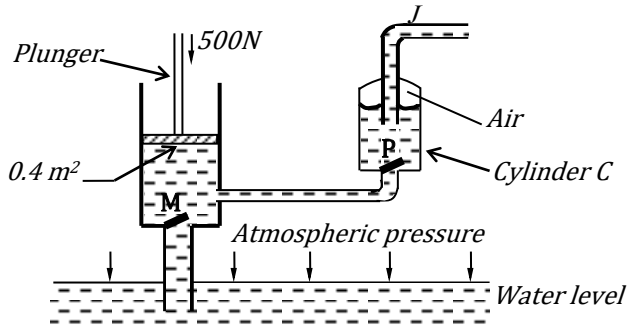


Figure **3**

(i) Describe the action of the pump.
(ii) If the downward force of 500 N is exerted on the plunger whose surface area is 0.4 m^2, calculate the pressure which forces water into cylinder C.

3. (a) What is the difference between speed and velocity?

(b) The graph in figure **4** shows the variation of distance with time for a body. Describe the motion of the body.

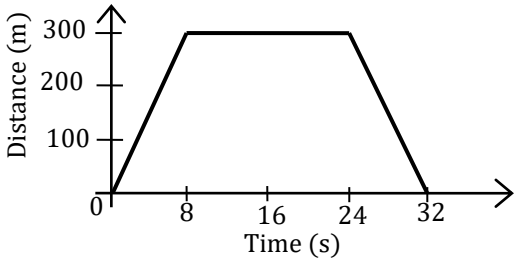


Figure **4**

(c) Describe an experiment to demonstrate friction compensation using and inclined plane.

(d) Figure **5** shows dots produced on a tape pulled through a ticker-timer by a moving body.

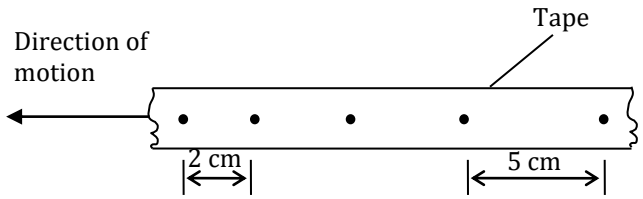


Figure **5**

The frequency of the ticker-timer is 50 Hz. Calculate the acceleration of the body.

4. (a) The diagram in figure **6** shows a ray of yellow light incident at an angle of 50^0 on one side of an equilateral triangular glass prism of refractive index 1.52.

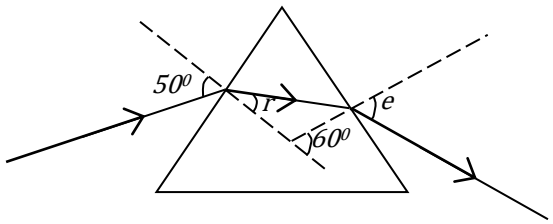


Figure **6**

(i) Calculate the angles marked *r* and *e*.

(ii) State and explain what would be observed if the ray above were of white light.

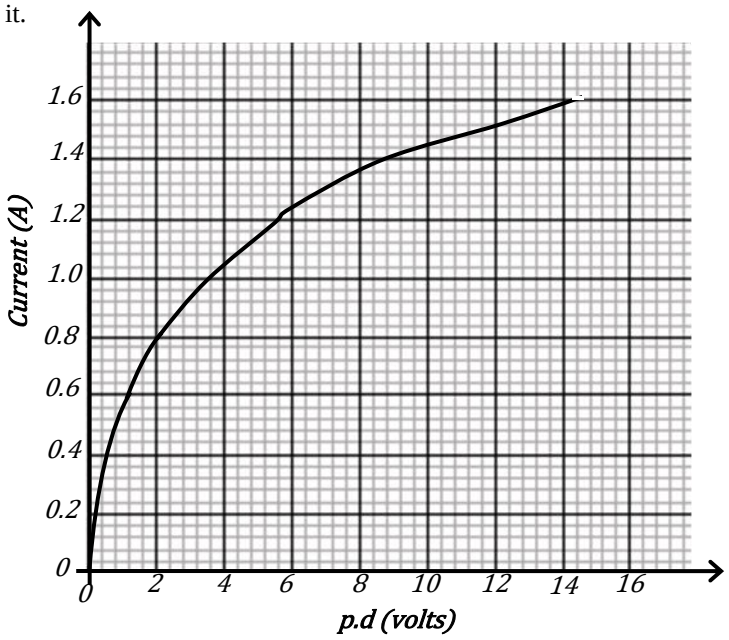
(b) Explain, with the aid of a diagram, why the writing on a piece of paper placed under a glass block appears raised when observed from above.

(c) State

(i) the conditions necessary for total internal reflection to occur.

(ii) one application of total internal reflection.

5. (a) The graph below shows the variation of current through a tungsten filament with a p.d across it.



(i) Draw a suitable circuit diagram to show how the results in the graph can be obtained.
(ii) State what happens to the resistance of the filament as current increases.
(iii) Using the graph, determine the resistance of the filament when the current is 0.7 A

(b) An electric heater of resistance 40 Ω is connected to a 240 V mains. How long will it take to raise the temperature of 4 kg of water from 40 ^{0}C to 100 ^{0}C.

(c) With the aid of a labeled diagram, explain how a dry cell works.

6. (a) Describe a simple experiment to show the existence of surface tension in water.

(b) A solution is made by dissolving 1 cm ^{3} of cooking oil in 199 cm ^{3} of methanol. When 0.004 cm ^{3} of the solution is dropped on the surface of water, an oil film of diameter 12 cm is obtained.

(i) Estimate the thickness of a molecule of the cooking oil.
(ii) State an assumption made in (b) (i).

(c) Smoke confined in an illuminated cell is observed through a microscope.

(i) State what is observed.
(ii) What conclusion can be drawn from the observation in (c) (i)?

7. (a) Explain how a piece of iron can be magnetized by the single touch method. Illustrate your answer with a diagram.

(b) How can you determine the polarity of a magnet?

(c) Explain why a magnet loses its magnetism when placed in a coil of wire carrying an alternating current.

(d) Describe the motion of a beam of electrons directed midway between the north and the south poles of a permanent magnet.

8. (a) Two identical sources are made to produce circular waves in a ripple tank. With the aid of a diagram, explain how interference fringes may be obtained.

(b) State two similarities between water waves and electromagnet waves.

(c) Describe a simple method of detecting ultraviolet radiations.

(d) *A radio station broadcasts on 49 metre band*.

(i) What is meant by the above statement?
(ii) Calculate the frequency of the broadcast.
(iii) Explain how radio waves are transmitted.

END

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PHYSICS
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Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

Mathematical tables, slide and non programmable electronic calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}

1. (a) What is meant by *acceleration*?

(b)

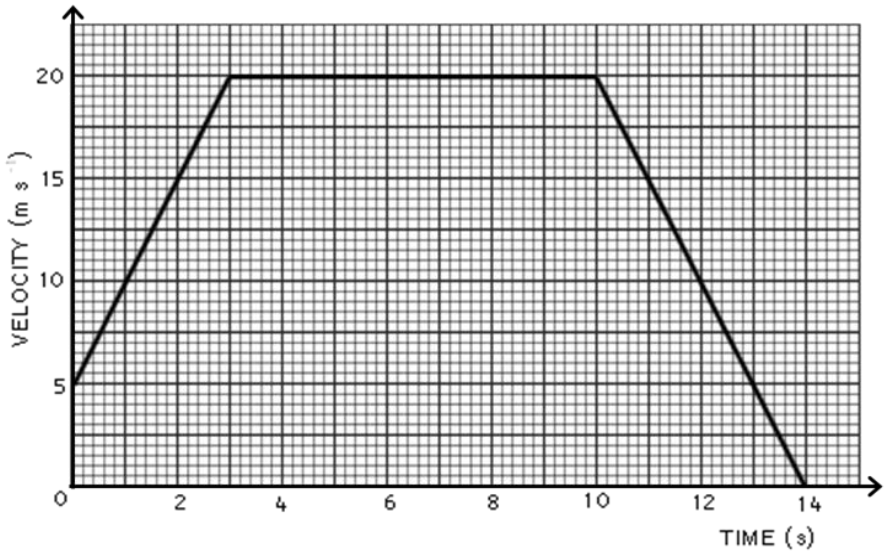

Figure **1**

Figure **1** shows a speed-time graph of a cyclist.

(i) Find the acceleration of the cyclist between *A* and *B*.
(ii) Describe the motion of the cyclist between *B* and *C*.
(iii) Explain what is happening along *CD*.
(iv) Calculate the distance travelled by the cyclist during the first ten seconds.

(c) (i) State Hooke's law.
(ii) A force of 100 N stretches an elastic spring by 2 cm. What force would stretch the same spring by 3.5 cm?

2. (a) Define

(i) *inertia of a body*.
(ii) *momentum*.

(b) Explain why a passenger standing on the floor jerks backwards when the lorry starts moving forward.

(c) Briefly describe an experiment to locate the centre of gravity of an irregular lamina.

(d) A 7-tonne truck initially moving at a velocity of 50 m s^{-1} accelerates to 80 m s^{-1} in 3 seconds. Calculate the force on the truck that caused the velocity change.

3. (a) What is meant by the following terms

(i) *critical angle*.
(ii) *total internal reflection.*

(b) Explain briefly how sky radio waves travel from a transmitting station to a receiver.

(c) State **two** applications of converging lenses.

(d) An object 8 cm high is placed perpendicularly on the principal axis 12 cm away from a diverging lens. With the aid of a ray diagram, find the focal length of the lens, if the height of the image formed is 2 cm.

4. (a) Distinguish between *specific heat capacity* and *specific latent heat* of a substance.

(b)

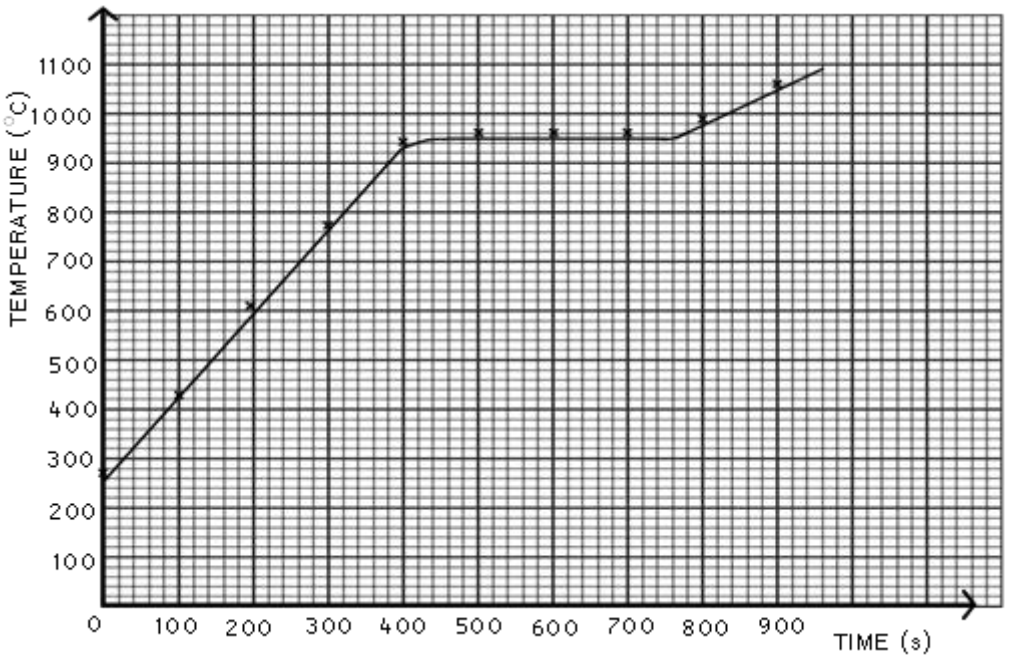

Figure **2**

The graph in figure **2** shows the variation of temperature of a metal with time.

(i) Using the graph, explain what happens to the metal.
(ii) What will the temperature of the metal be after 1000 s?
(iii) If the metal absorbs heat at the rate of 2500 J s^{-1} and the heat capacity is 300 J kg^{-1} K^{-1}, calculate the mass of the metal.
(iv) Find the specific latent heat of the metal.

5. (a) (i) Describe an experiment to distinguish between soft and hard magnetic material.
(ii) State **one** instance in which each of these materials is used.

(b)

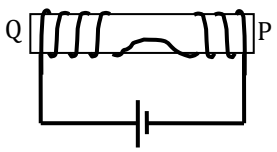

Figure **3**

Figure **3** shows how a magnetic material can be magnetized by electrical method.

(i) Indicate the direction of current in the coil.
(ii) Name the polarities *P* and *Q*.

(c) Describe how you can determine the polarity of a magnet.

6. (a) What is meant by the terms

(i) *isotopes*,
(ii) *atomic number*.

(b) (i) Name and state the nature of emissions from radioactive nuclides.
(ii) What effect does each of the emissions have on the parent nuclide?

(c) A radioactive sample has a half-life of 3×10^3 years.

(i) What does the statement *half-life of* 3×10^3 *years* mean?
(ii) How long does it take for three quarters of the sample to decay?

(d) Give **two** uses of radioactivity.

7. (a) Explain what is meant by *dispersion of light*.

(b) With the aid of a diagram, describe an experiment to produce a pure spectrum.

(c) State why most hind registration number plates are painted black on a yellow background.

(d) Explain why the sun appears red at sunrise and sunset.

8. (a) Sketch the current versus p.d variation for

(i) Metal wire,
(ii) Semi-conductor diode.

(b)

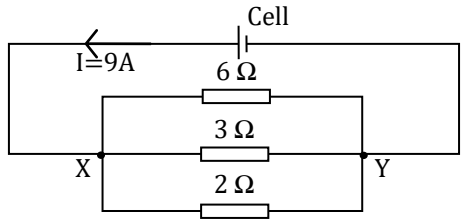

Figure **4**

Figure **4** shows a cell of negligible internal resistance connected to a system of resistors.

(i) e.m.f of the cell
(ii) the current through the 3 Ω resistor.
(iii) the power dissipation in the 3 Ω resistor.

(c) Describe the energy changes which occur from the time an electric bulb is switched on.

END

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UGANDA NATIONAL EXAMINATIONS BOARD

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PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) State the principle of moments.

(b) A uniform metre rule of weight 1 N is pivoted on a wedge 5 cm away from one end and suspended by a string 30 cm from the other end.

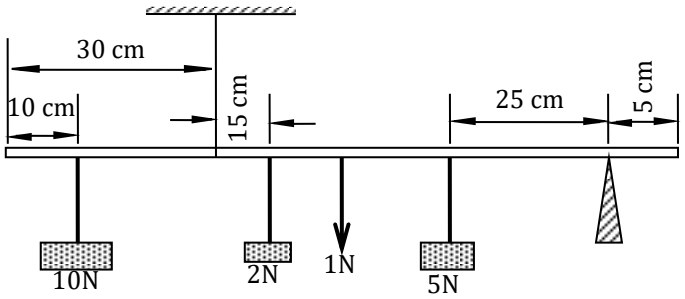

Figure **1**

If the metre rule is in equilibrium when the weights of 10 N, 2 N and 5 N are attached to it as shown in figure **1**, calculate the:

(i) tension in the string.
(ii) normal reaction, R at the wedge.

(c) (i) What is meant by *dynamic friction*.
(ii) Describe, with the aid of a diagram, an experiment to determine the limiting friction between two surfaces in contact.
(iii) State any **one** factor which affects friction.

(d) Give **one** application of friction.

2. (a) What do you understand by the following terms as applied to motion.

(i) *uniform velocity*,
(ii) *uniform acceleration*?

(b) The table below shows the variation of velocity with time for a body which has been thrown vertically upwards from the surface of a planet.

Velocity (m s^{-1})	8	6	4	2	0	-2
Time (s)	0	1	2	3	4	5

(i) What does the negative velocity mean?
(ii) Plot a graph of velocity against time.
(iii) Use the graph in (b) (ii) to find the acceleration due to gravity on the planet.
(iv) Use the graph in (b) (ii) to find the total distance travelled.
(v) If the body weighs 34 N on earth, what is its weight on the planet?

3. (a) State the kinetic theory of matter.

(b) State the law of volume and temperature (Charles's law)

The volume of a fixed mass of a gas at a given pressure is 1.5 m^3 at 300 K. At what temperature will the volume of the gas be 0.5 m^3 at the same pressure?

(c) Describe an experiment to determine the fixed points of a thermometer.

(d) (i) Mention any **three** reasons for not using water as a thermometric liquid.
(ii) When a Celsius thermometer is inserted in a boiling liquid, the mercury thread rises above the lower fixed point by 19.5 cm. Find the temperature of the boiling liquid if the fundamental interval is 25 cm.

4. (a) Describe an experiment to demonstrate the laws of reflection of light.

(b) With the aid of a diagram, illustrate how the shadows are formed when an opaque object is placed between an extended source of light, and a screen.

(c) An object 10 cm high is placed at a distance of 25 cm from a convex mirror of focal length 10 cm.

(i) Draw a ray diagram to locate the position of the image.
(ii) Calculate the magnification.

(d) Give reasons for use of convex mirrors in vehicles.

5. (a) List three differences between sound waves and radio waves.

(b) Figure **2** shows waves propagating towards a concave reflector.

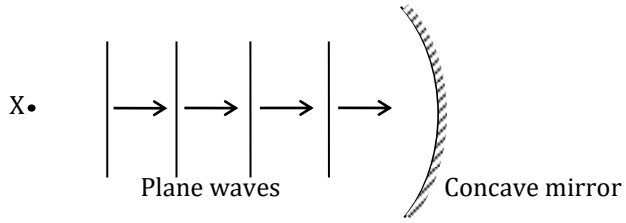

Figure **2**

(i) Draw a diagram to show how the waves will be reflected.
(ii) If the velocity of the waves is 320 m s^{-1} and the distance between two successive crests is 10 cm, find the period of the waves.

(c) Describe a simple echo method experiment of determining the speed of sound in air.

6. (a) What is an *alpha particle*?

(b)

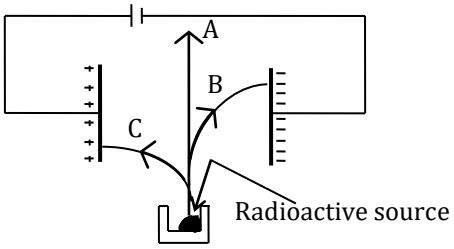

Figure **3**

A radioactive source decays by emission of all the three radiations. The radiations enter normally into an electric field as shown in figure **3**. Which radiation is most likely to be detected at

(i) position A,
(ii) position B,
(iii) position C?

(c)

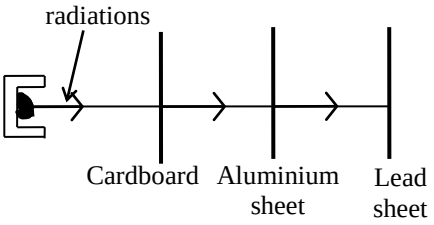

Figure **4**

A radioactive source which emits all the three radiations is placed in front of a cardboard, aluminium and lead sheet as shown in figure **4**. Name the radiations likely to be between the,

(i) cardboard and the aluminium sheet,
(ii) aluminium and lead sheets.

(d) Name the three precautions which must be undertaken by one working with ionizing radiation.

(e) Name one

(i) industrial use,
(ii) biological use of radioactivity.

(f) A radioactive material of mass 8 g has a half-life of 20 days. Find how much of it will decay after 60 days.

7. (a) What is a *transformer*?

(b)

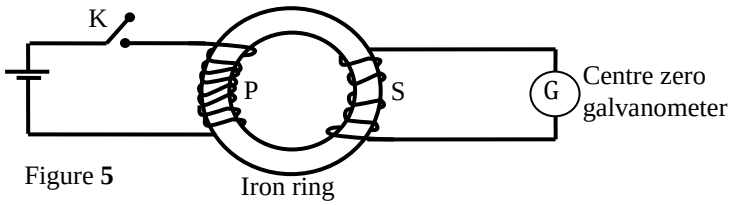

Figure **5**

The diagram in figure **5** shows a model of a transformer in which the primary coil, *P* connected to d.c and the secondary coil, *S* is connected to a galvanometer.

(i) What is observed just as the switch *K* is closed?
(ii) What would be the effect of closing switch *K* very fast in (i) above?
(iii) What is observed when the switch *K* is left closed?
(iv) What is observed just as switch K is opened?
(v) What would be observed if the d.c source is replaced by an a.c source of low frequency?

(c) A transformer of efficiency 80% is connected to a 240 V a.c supply to operate a heater of resistance 240 Ω. If the current flowing in the primary circuit is 5 A,

(i) calculate the potential difference p.d) across the heater.
(ii) and the transformer is cooled by oil of specific heat capacity 2100 J kg^{-1} K^{-1} and the of the oil rises by 20 ^{0}C in 3 minutes, find the mass of the oil in the transformer.

8. (a)

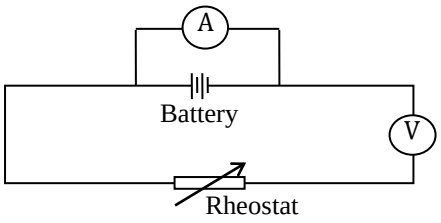

Figure **6**

An ammeter A and voltmeter V are connected in circuit as shown in figure **6**. What can you say about these connections?

(b)

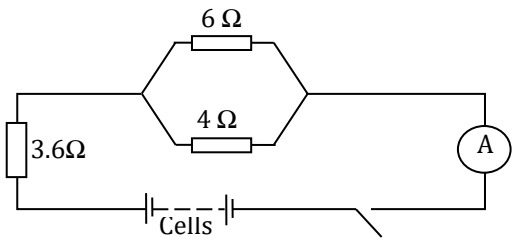

Figure **7**

Three resistors of 6Ω, 4Ω, and 3.6Ω are connected to eight identical cells of negligible internal resistance connected in series as shown in figure **7**. If the ammeter reads 2 A, when the switch is closed, determine the:

(i) current through the 4Ω resistor.

(ii) e.m.f of each cell.

(c) Abbot paid electricity a bill of shs. 180 after using two identical bulbs for two hours every day for ten days at a cost of shs.60 per unit.

(i) Determine the power consumption by each bulbs.
(ii) State the energy changes that occur in the bulb.

END

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Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Mathematical tables, slide rules and silent non programmable calculators maybe used.

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Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	2000 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) Distinguish between the **weight** and **mass** of a body.

(b) The force of gravity on the moon is one-sixth of that on the earth. Determine the weight of a **12 kg** mass on the moon.

(c) (i) What is meant by ***centre of gravity***?
(ii) Describe an experiment to determine the centre of gravity of an irregular lamina.

(d) (i) Sketch the distance –time graph for a body falling freely from rest.
(ii) An object is released from rest at a height of **0.5 km**. How long does it take to reach the ground?

2. (a) Distinguish between boiling and evaporation.

(b) The graph in figure **1** shows a cooling curve of a liquid. Describe the main features of the curve.

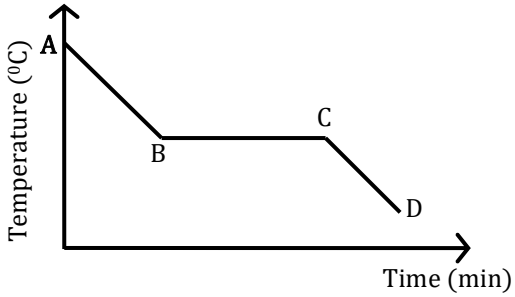


Figure **1**

(c) (i) Define the term ***specific latent heat of fusion***.
(ii) A copper can of mass **0.2 kg** contains **0.20 kg** of water at **10 ^{0}C**. The can and its contents are placed in a refrigerator. Calculate the quantity of heat given out if the temperature of the can and its contents falls to **-2 ^{0}C**.

(d) Name **two** main features of a vacuum flask which enable it to keep a liquid warm.

3. (a) Define ***efficiency of a machine***.

(b) The diagram in figure **2** represents a pulley system in which an effort, ***E*** is applied to raise the load, ***L***.

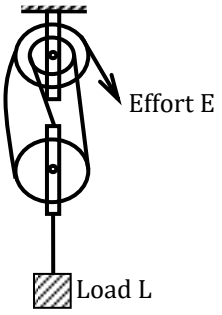


Figure **2**

(i) Copy the diagram and indicate the forces acting on the string.
(ii) What is the velocity ratio of the system?
(iii) How far will the load move if the effort moves by **2.4 m**?
(iv) What effort will just raise a load of **960 N**, if the mechanical advantage is **2.4**?
(v) Use your results above to calculate the efficiency of the pulley system.

(c) (i) Draw a sketch graph to show how the mechanical advantage of the pulley system in (b) varies with the load.
(ii) Explain the features of the sketch in (c) (i).

(d) Give **two** practical examples where pulley systems are used.

4. (a) (i) What is meant by ***radioisotope***.
(ii) State **one** medical and **one** industrial application of radioisotopes.

(b) Describe what happens when a beam of radiations consisting of **α-**, **β-,** and **γ-**rays is incident on a thin sheet of lead.

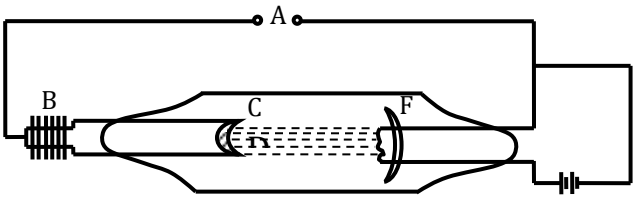


Figure **3**

The diagram in figure **3** shows the essential parts of an **X**-ray tube

(i) Name the parts ***A***, ***B***, ***C***, ***D***, ***E*** and ***F***.
(ii) State the function of each part.
(iii) Describe how X-rays are produced.

(d) What safety precautions must be taken in an **X**-ray laboratory?

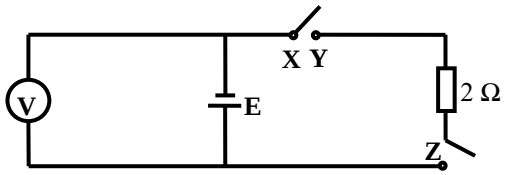
5. (a) What is an ***echo***.

(b) (i) Describe an experiment to measure the speed of sound in air.
(ii) State any **two** likely sources of error in the experiment.

(c) Describe an experiment to determine how the frequency of a vibrating string depends on the length of the string.

6. (a) (i) Distinguish between a conductor an insulator.
(ii) Describe, stating the observations made, how a gold leaf electroscope can be charged positively.

(b) A cell of **e.m.f.** ***E*** and internal resistance **1.0 Ω** is connected in series with a **2Ω** resistor and a switch as shown in figure **4**. The voltmeter reads **1.5 V** when the switch is open.



(i) What is meant by ***e.m.f.*** of a cell?
(ii) Find the value of ***E***.
(iii) What will the voltmeter read when the switch is closed?
(iv) What will the voltmeter read if **X** is connected to **Z**?
Give reasons for your answer.

7. (a) Describe an experiment to show that light travels in straight line.

(b) An object of height **4 cm** is placed **5 cm** away from a pinhole camera. The screen is **7 cm** from the pinhole.

(i) Draw to scale a ray diagram to show the formation of the image by the pinhole camera.
(ii) What is the nature of the image?
(iii) Find the magnification.
(iv) Explain what happens to the image if the pinhole is made larger.

(c) Draw a diagram to show the formation of solar eclipse.

8. (a) Describe a simple experiment to measure the internal resistance of a cell.

(b)

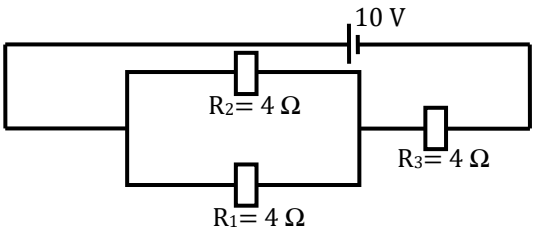


Figure **5**

A battery of **e.m.f. 10 V** and negligible internal resistance is connected to resistors $\boldsymbol{R_1}$, $\boldsymbol{R_2}$ and $\boldsymbol{R_3}$ of resistances **6 Ω**, **4 Ω** and **2.6 Ω** respectively as shown in figure **5**.

(i) Calculate the effective resistance of the circuit.

(ii) Find the rate at which the electrical resistance is converted to heat energy in $\boldsymbol{R_3}$.

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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Acceleration due gravity, g	=	10 m s^{-2}
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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) Define the term *acceleration*.

(b) A body attached to a string is swung in a vertical circular path in air as shown in figure **1**

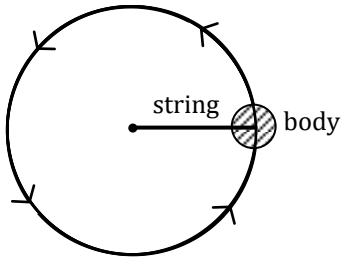

Figure**1**

Copy the above diagram and on it indicate and name all the forces acting on the body if the body is moving in an anticlockwise direction.

(c) Explain why the weight of an object on the earth's surface may vary from one place to another.

(d) A ball of mass 0.25 kg is dropped from rest at a height of 20 m above the ground.

(i) Calculate the time it takes to reach the ground.
(ii) If the ball bounced once on hitting the ground and lost 20% of its original energy, calculate the maximum height the ball reached again.

2. (a) Define the following terms:

(i) *mechanical advantage*.
(ii) *velocity ratio*

(b)

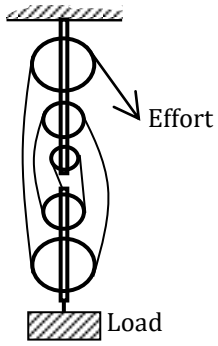

Figure **2**

The diagram in figure **2** shows a pulley system used to raise a load.

(i) What is the velocity ratio of the system?
(ii) Find how far the load is raised, if the effort moves down by 4 m.
(iii) Calculate the effort required to raise a load of 800 N, if the mechanical advantage of the system is 4.
(iv) Calculate the efficiency of the system.

(c) Explain what happens to the efficiency of the system in (b) above, if the load is much

(i) less than 800 N,
(ii) more than 800 N.

(d) Draw a sketch graph to show how mechanical advantage of the system in (b) varies with load.

(e) Give **two** practical applications where pulley systems are used.

3. (a) Define the term *specific latent heat of vaporization*.

(b) Describe an experiment to determine the specific latent heat of vaporization of steam.

(c) A copper container of heat capacity 60 J kg $^{-1}$ contains 0.5 kg of water at 20 ^{0}C. Dry steam is passed into the water until the temperature of the container and water reaches 50 ^{0}C. Calculate the mass of steam condensed.

(d) (i) What is meant by *saturated vapour pressure*.
(ii) Explain what may happen when one is to cook food from a very high altitude.

4. (a) (i) Define *pressure* and state its units.
(ii) With the aid of a diagram, describe how you would show that the pressure of a liquid is independent of cross-sectional area of a container.

(b) Two manometers P and Q contain a liquid X, and water respectively at the same level. They are then connected to a thistle funnel covered with a rubber membrane as shown in figure **3**.

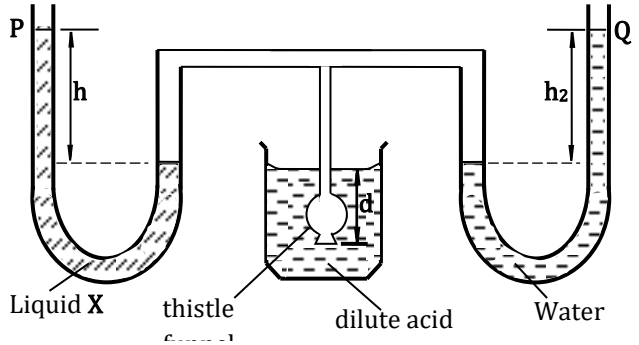

Figure **3**

When the thistle funnel is lowered into a beaker containing a dilute acid of density 1200 kg m $^{-3}$, the heights h_1 and $h_2$are 15 cm and 12 cm respectively. Find the:

(i) ratio of the density of liquid *x* to that of water,
(ii) depth d of the thistle funnel below the surface of the dilute acid.

(c) Explain why a ship floats in water although it is made mainly of metal.

5. (a) Define *half-life* of a radioactive substance.

(b) The mass of a radioactive substance decays to a $\frac{1}{16}^{th}$ of its original mass after 16 days.

What

(i) is its half-life?
(ii) fraction of the original mass will have decayed after 20 days?

(c)

$$^{232}_{90}\mathbf{X} \xrightarrow{\text{A}} {}^{228}_{88}\mathbf{Y} \xrightarrow{\text{B}} {}^{228}_{89}\mathbf{Z} \xrightarrow{\text{C}} {}^{228}_{89}\mathbf{Z}$$

(
(i) Identify the particles or radiations *A*, *B* and *C* emitted in the decay process shown above.
(ii) State two differences between radiations *A* and *B*.
(iii) Name two health hazards of radioactivity.
(iv) What is the difference between *nuclear fusion* and *nuclear fission*?

6. (a) (i) What is a *conductor*?

(ii) Give **two** examples of conductors.

(b) Describe how a gold leaf electroscope can be positively charged by electrostatic induction.

(c) Two polythene sheets A and B are both positively charged with equal amounts of charge. One end of each polythene sheet is fixed into an insulator and the two sheets brought near each other as shown in figure **4**.

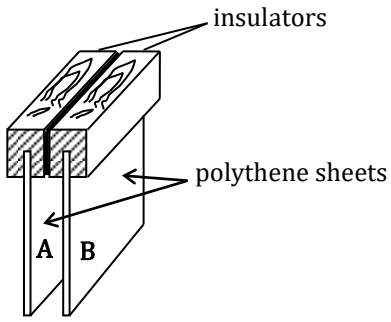

Figure **4**

(i) Describe and explain what happens.
(ii) Describe and explain what happens if an earthed sheet of metal is inserted between the polythene sheets without touching them.

(d) Explain how thunder is produced during a rainstorm.

7. (a) Use a ray diagram to show how a virtual image may be formed in a converging lens.

(b) A converging lens of focal length 20 cm forms a real image 4 cm high of an object which is 5 cm high. If the image is 36 cm away from the lens, determine by graphical method the position of the object.

(c) State **two** differences between a pin-hole camera and a lens camera.

(d) With the aid of a diagram explain why a pond appears shallower than it actually is.

(e) Using a labelled diagram, show how two right-angled isosceles prisms may be used to produce an erect image of a distant object.

8. (a) State any **two** factors which determine the magnitude of a force exerted on a current carrying conductor.

(b) With the aid of a well-labelled diagram, describe the structure and mode of operation of a moving-coil loudspeaker.

(c) State the factors which determine the pitch and loudness of sound produced by a moving-coil loudspeaker.

(d) A D.C motor has an armature resistance of 4 Ω. If it draws a current of 10 A when connected to a supply of 200 V, calculate the

(i) power wasted in the windings,
(ii) efficiency of the motor.

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

Mathematical tables, slide rules and silent non programmable scientific calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	$10\ m\ s^{-2}$
Specific heat capacity of water	=	$4.2 \times 10^3\ J\ kg^{-1}\ K^{-1}$
Specific heat capacity of copper	=	$400\ J\ kg^{-1}\ K^{-1}$
Specific latent heat of fusion of water	=	$0.33 \times 10^6\ J\ kg^{-1}$
Speed of sound in air	=	$320\ m\ s^{-1}$

1. (a) Define *displacement*. **Turn Over**

(b) Two vehicles A and B accelerate uniformly from rest. Vehicle A attains a maximum velocity of 30 ms $^{-1}$ while vehicle B attains a maximum velocity of 40 ms $^{-1}$ in the same time. Both vehicles maintain these velocities for 6 s. They are then decelerated such that A comes to rest after 6 s while B comes to rest after 4 s.

(i) Sketch on the same axes a velocity-time graph for the motion of the vehicles.
(ii) Calculate the velocity of each vehicle 18 s after the start.
(iii) How far will the two vehicles be from one another during this moment in (ii) above?

(c) Describe a simple experiment to measure the acceleration due to gravity.

2. (a) Define the term *pressure*.

(b) (i) Describe how a simple mercury barometer can be set up to measure the atmospheric pressure.
(ii) The difference between the atmospheric pressure at the top of a mountain is 1 x 10^4 Nm $^{-2}$. If the density of air is 1.25 kg m $^{-3}$, calculate the height of the mountain.

(c) (i) State the principle of transmission of pressure in fluids.
(ii) Give **one** assumption on which the principle is based.
(iii) State **two** applications of the principle.
(iv) In figure **1**, piston A has diameter of 14 cm while B has diameter of 280 cm. If the force of 77 N is exerted on piston A, calculate the force exerted by piston B.

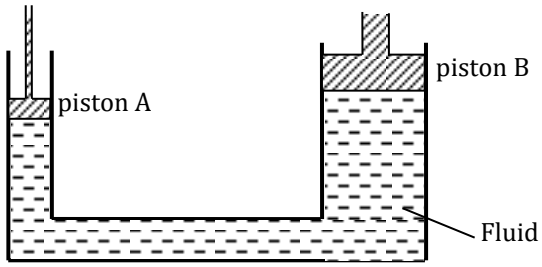

Figure **1**

3. (a) What is meant by *latent heat of vaporization*?

(b) With the aid of a labelled diagram, describe how a refrigerator works.

(c) The cooling system of a refrigerator extracts 0.7 kW of heat. How long will it to convert 500 g of water at 20 ^{0}C into ice.

(d) Explain how evaporation takes place.

4. (a) Name the electromagnetic radiation which

(i) causes sensation of heat.
(ii) passes through a thin sheet of lead.
(iii) is used in satellite communication.
(iv) is used to for remote control of a television receiver.

Figure **2** shows the main parts of an X-ray tube.

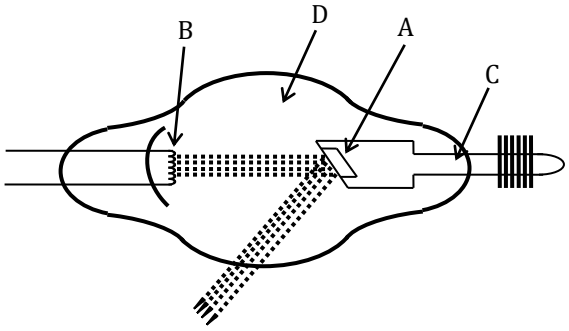

Figure **2**

(b) Name the parts labelled A, B, C and D

(c) List in order the energy changes which occur in the X-ray tube.

(d) Describe one industrial use of X-rays.

(e) (i) What is meant by *half-life of a radioactive material*?
(ii) The activity of a radioactive source decreases from 4000 counts per minute to 250 counts per minute in 40 minutes. What is the half-life of the source?

5. (a) Explain the causes of refraction of light.

(b) Describe an experiment you would use to measure the refractive index of a glass using a glass block.

(c) (i) State the conditions for total internal reflection to occur.
(ii) State one application of total internal reflection.
(iii) Calculate the critical angle for an air-glass interface if refractive index of glass is 1.5.

6. (a) State **three** differences between sound and light energy.

(b) (i) Explain how stationary waves are formed.
(ii) State three main characteristics of stationary waves.

(c) (i) Define the term *frequency* and *wavelength* as applied to sound.
(ii) Describe an experiment to demonstrate resonance in sound.

(d) The velocity and frequency of sound in air at certain time were 320 ms^{-1} and 200 Hz respectively. At a later time, the air temperature changed and the velocity of the sound in air was found to be 340 ms^{-1}. Determine the change in wavelength of the sound.

7. (a) What happens when a glass rod is rubbed with:

(i) silk?
(ii) an identical glass rod?

(b) Describe how a gold leaf electroscope may be used to test for the nature of charge on an object.

(c) Draw the electric field patterns for:

(i) an insulated negative charge.
(ii) two oppositely charged parallel plates at a small distance apart.

(d) Explain why it is not advisable to touch a copper strip of a lightning conductor when it is raining.

8. (a) Describe the structure and action of a fluorescent tube.

(b) Give one advantage of a fluorescent tube over a filament lamp.

(c) Describe the function of:

(i) a fuse,
(ii) an earth wire.

(d) Describe briefly how power is transmitted from a power station to a home.

(e) Find the cost of running two 60 W lamps for20 hours if the cost of each unit is shs. 40.

END

535/2
PHYSICS
Paper 2
Nov. / Dec.2001
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Mathematical tables, slide rules and silent non programmable calculators maybe used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) State the principle of conservation of linear momentum. *(1 mark)*

(b) A trolley of mass 150 g moving with a velocity 20 ms $^{-1}$ collides with another stationary trolley Q of mass 100 g. If P and Q move together after collision, calculate

(i) the momentum of P before collision, *(3 marks)*
(ii) the velocity with which P and Q move after collision. *(3 marks)*

(c)

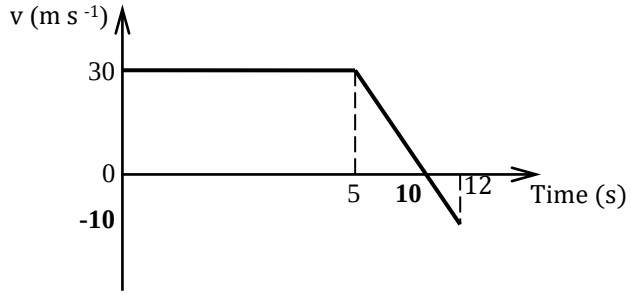

Figure **1**

Figure **1** represents a velocity-time graph for the motion of a car. If the mass of the car is 500 kg, find

(i) the distance it has travelled from the start of its motion. *(4 marks)*
(ii) the time it takes to get back to the starting point if its velocity is then maintained constant. *(2 marks)*
(iii) the momentum of the car just before deceleration. *(3 marks)*

2. (a) State Archimede's principle *(1 mark)*

(b) (i) Describe an experiment to verify the law of floatation. *(6 marks)*
(ii) Give one example where the law of floatation is applied. *(1 mark)*

(c) (i) Define density. *(1 mark)*
(ii) A piece of glass weighs 0.5 N in air and 0.30 N in water. Find the density of glass. *(7 marks)*

3. (a) With the aid of a labelled diagram, describe an experiment to show how the volume of a gas varies with pressure at a constant temperature. *(6 marks)*

(b) A gas of volume 1000 cm ^{3} at a pressure of 4.0 x 10^5 Pa and temperature 17 ^{o}C is heated to 89.5 ^{o}C at a constant pressure. Find the new volume of the gas. *(4 marks)*

(c) A balloon is filled with 50 cm ^{3} of hydrogen and tied to the ground. The balloon alone, and the content which it carries have a mass of 2.0 kg. If the densities of hydrogen and air are 9.0 x 10^{-2} kg m^{-3} and 1.29 kg m^{-3} respectively, how much load can the balloon lift when released? *(6 marks)*

4. (a) Describe a simple model of an atom. *(4 marks)*

(b) Define the following:

(i) atomic number, *(1 mark)*
(ii) isotopes of an element. *(1 mark)*

(c) State **two** differences between an α- and a β- particle. *(2 marks)*

(d) (i) What is meant by nuclear *fission* and nuclear *fusion*. *(2 marks)*
(ii) Give one example of where each one occurs. *(2 marks)*

(e) The half-life of a radioactive substance is 24 days. Calculate the mass of the substance which has decayed after 72 days if the original mass is 0.64 g. *(4 marks)*

5. (a) With the aid of a diagram explain the terms *amplitude* and *wavelength* as applied to wave motion. *(2 marks)*

(b) (i) Derive an equation relating velocity V, frequency f, and wavelength λ, of a wave. *(4 marks)*

(ii) A radio wave is transmitted at a frequency of 150 MHz. Calculate its wavelength. *(3 marks)*

(c) (i) List **four** properties of electromagnetic waves. *(3 marks)*

(ii) A long open tube is partially immersed in water and a tuning fork of frequency 425 Hz is sounded and held above it. If the tube is gradually raised, find the length of the air column when resonance first occurs.
[Neglect the end correction].
[Speed of sound in air = 340 ms $^{-1}$] *(4 marks)*

6. (a) Describe briefly the structure and action of an a.c transformer. *(5 marks)*

(b) (i) State any **three** causes of energy loses in a transformer.
(ii) How are these energy loses reduced in a practical transformer? *(3 marks)*

(c) Explain why it is an advantage to transmit electrical power at high voltage. *(3 marks)*

(d) Electric power is generated at 11 kV. Transformers are used to raise the voltage to 440 kV for transmission over large distances using cables. The output of the transformers is 19.8 MW and they are 90% efficient. Find

(i) the input current to the transformer. *(3 marks)*
(ii) the output current to the cables. *(2 marks)*

7. (a) With the aid of a diagram, explain briefly how a pure spectrum may be produced. *(6 marks)*

(b) (i) What are primary colours? Name them. *(2 marks)*
(ii) Explain briefly what happens when white light falls on a green body. *(2 marks)*

(c) With the aid of a labelled diagram, describe how a lens camera works. *(6 marks)*

8. (a) Draw a magnetic field pattern due to an electric current in:

(i) a circular coil, *(2 marks)*
(ii) a solenoid. *(2 marks)*

(b) With the aid of a labelled diagram, describe briefly the action of an electric bell. *(7 marks)*

(c) What is meant by the following:

(i) magnetic meridian, *(1 mark)*
(ii) neutral point in a magnetic field? *(1 mark)*

(d) Describe briefly how a steel bar may be magnetized. *(3 marks)*

END

Name …… Centre and Index No. ……/……

Signature ……

535/2
PHYSICS
Paper 2
Nov. / Dec.2002
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a)

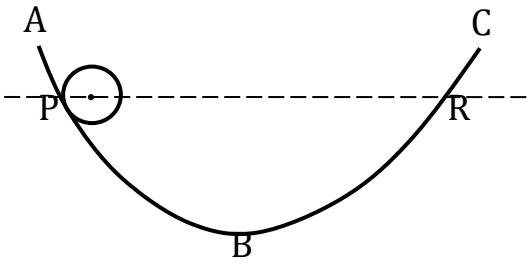

Figure **1**

The diagram in figure **1** shows a large smooth bowl ABC. Explain what happens when a ball is released from P. *(05 marks)*

(b) Describe how you would measure the mass of a uniform metre rule using a known mass and a knife edge only. *(06 marks)*

(c) In a pulley system, the distance moved an effort is five (5) times the distance moved by a load. Calculate the efficiency of the system if an effort required just to move a load of 60 N is 20 N. *(05 marks)*

2. (a) What is meant by *conduction*? *(01 mark)*

(b) Draw a labelled diagram of a thermos flask and explain how it is able to keep a liquid cold for a longtime. *(05 marks)*

(c) With the help of a diagram, describe how you would determine the upper fixed point of an uncalibrated thermometer. *(04 marks)*

(d) Explain the following observations:

(i) a bare cement floor feels colder than a carpeted one. *(03 marks)*
(ii) a beam with a notch; that is used for constructing a bridge, lasts longer when the notch is on its top surface than when the notch is on its surface. *(03 marks)*

3. (a) With the aid of a diagram, describe the effect of a shear force on a body. *(03 marks)*

(b) (i) What is meant by *strength* as applied to a material? *(01 mark)*
(ii) State the factors on which strength of a material depends. *(02 marks)*

(c) Describe a simple experiment to verify Hooke's law using a spring. *(05 marks)*

(d) (i) What is *concrete*? *(01 mark)*
(ii) State any three characteristics of concrete which make it desirable building material. *(05 marks)*

4. (a) (i) Describe how the speed of waves in a ripple tank can be decreased. *(02 marks)*
(ii) Explain the effect of decreasing the speed of the wave in (a) (i) on the frequency. *(02 marks)*

(b) With the aid of sketch diagrams, explain the effect of size of a gap on diffraction of waves. *(04 marks)*

(c) (i) Give **two** reasons why sound is louder at night than during the day. *(03 marks)*
(ii) An echo-sounding equipment on a ship receives sound pulses reflected from the sea bed 0.02 s after they were sent out from it. If the speed of sound in water is 1500 ms^{-1}, calculate the depth of water under the ship. *(03 marks)*

(d) Identify **two** differences between water and sound waves. *(02 marks)*

5. (a) With the aid of diagrams, distinguish between diffuse and regular reflection. *(05 marks)*

(b)

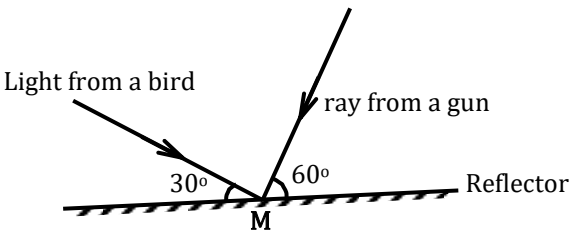

Figure **2**

A ray from a bird makes an angle of 30° with a plane reflector and a ray from the barrel of a gun makes an angle of 60° to the same reflector at the same point, M as shown in figure **2**. Find the angle through which the reflector must be rotated about M such that the ray from the barrel of the gun falls on the bird. *(05 marks)*

(c) With the aid of a diagram explain why a parabolic mirror is most suitable for use in car headlights. *(03 marks)*

(d) List **three** uses of a concave mirror. *(03 marks)*

6. (a) Explain what happens when a magnet is

(i) dipped in iron fillings. *(02 marks)*
(ii) freely suspended in air. *(02 marks)*

(b)

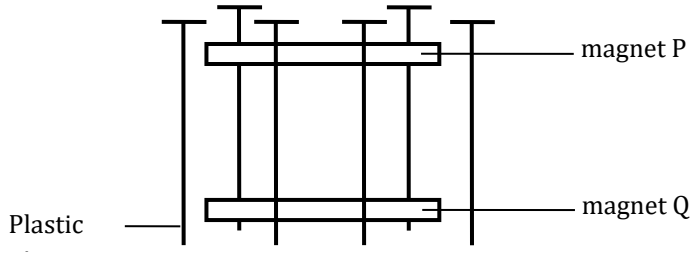

Figure **3**

A powerful magnet Q is placed on a soft board. Plastic pins are firmly stuck in the soft board around the magnet. An identical magnet P is held in the space surrounded by the pins above the magnet Q as shown in figure **3**.

(i) Explain why P floats above Q. *(03 marks)*
(ii) Why are plastic pins used instead of steel pins? *(03 marks)*
(iii) What would happen to magnet P if all the pins were removed at the same time? *(02 marks)*

(c) Explain in terms of the domain theory how a steel bar gets magnetized by stroking. *(04 marks)*

7. (a) Draw sketch graphs of p.d, V, against current, I, for the following:

(i) a wire,
(ii) an electrolyte,
(iii) a semi-conductor diode. *(03 marks)*

(b) Explain the differences between a voltmeter and an ammeter in terms of their

(i) construction, *(02 marks)*
(ii) use. *(02 marks)*

(c) State three physical properties that affect the resistance of a solid conductor. *(03 marks)*

(d)

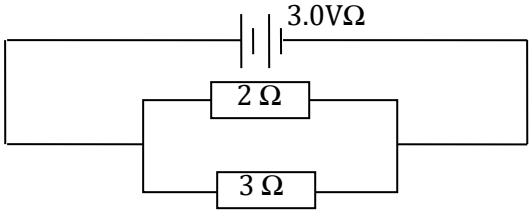

Figure **4**

Two cells each of e.m.f 1.5 V and negligible internal resistance are connected in series across two resistors of 2Ω and 3Ω as shown in figure **4**. Calculate the current:

(i) supplied by the cells, *(04 marks)*
(ii) that passes through the 3 Ω resistor. *(02 marks)*

8. (a)

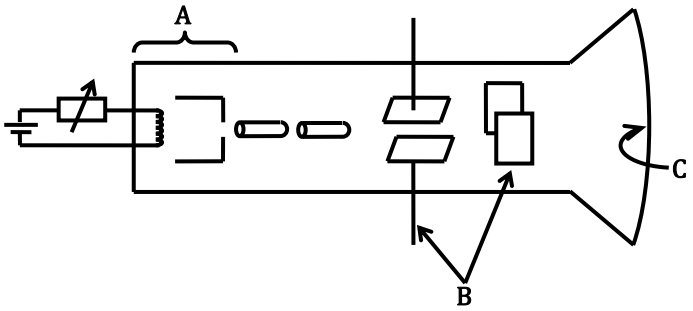

Figure **5**

The diagram in figure **5** shows the main parts of a cathode ray oscilloscope (C.R.O).

(i) Name the parts labelled A, B, and C. *(03 marks)*
(ii) Why is the C.R.O evacuated? *(02 marks)*

(b) (i) Describe briefly the principles of operation of C.R.O. *(04 marks)*
(ii) How is the bright spot formed on the screen? *(02 marks)*

(c) Use diagrams to show what is observed on the screen of a C.R.O when

(i) the C.R.O is switched on and no signal is applied to the Y-plates. *(01 mark)*
(ii) the time-base is switched on and no signal is applied to the Y-plates. *(01 mark)*
(iii) an alternating signal is applied to the Y-plates while the time-base is switched off. *(01 mark)*

(d) Give two uses of the C.R.O. *(02marks)*

END

535/2
PHYSICS
Paper 2
Nov. / Dec.2003
2 $^{1}/_{4}$ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) Define the following:

(i) Velocity, *(1 mark)*
(ii) Momentum. *(1 mark)*

(b) A small iron ball dropped from the top of a vertical cliff takes 2.5 s to reach the bottom of the cliff. Find

(i) the speed with which it strikes the bottom, *(3 marks)*
(ii) the height of the cliff. *(3 marks)*

(c) Explain briefly why a person feels heavier than usual at the instant a lift suddenly starts accelerating upwards. *(5 marks)*

(d) A valve of a cylinder containing 12 kg of compressed gas is opened and the cylinder empties in 90 s. If the gas flows out of the nozzle at an average speed of 25 ms $^{-1}$, find the average force exerted on the cylinder. *(3 marks)*

2. (a) Define a joule. *(1 mark)*

(b) (i) What is meant by linear momentum? *(1 mark)*
(ii) State the law of conservation of linear momentum. *(1 mark)*

(c) A bullet of mass 20 g is fired into a block of wood of mass 400 g lying on a smooth horizontal surface. If the bullet and the wood move together with a speed of 20 ms $^{-1}$, calculate,

(i) the speed with which the bullet hits the wood, *(4 marks)*
(ii) the kinetic energy lost. *(6 marks)*

(d) State the energy changes involved in (c) above. *(2 marks)*

3. (a) (i) What is meant by *diffusion*? *(1 mark)*
(ii) State the factors on which diffusion depends. *(2 marks)*

(b) Describe an experiment to show diffusion in liquids. *(4 marks)*

(c)

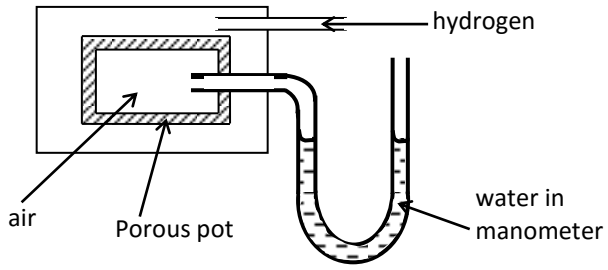


Figure **1**

A porous pot containing air is connected to a water manometer. Explain what happens if hydrogen is let in the space surrounding the pot as shown in figure **1** *(4 marks)*

(d) (i) Describe a simple experiment to show surface tension in water. *(3 marks)*
(ii) State **two** factors which affect surface tension. *(2 marks)*

4. (a) What is an equation of state of a gas? *(1 mark)*

(b) (i) With the aid of a sketch graph, describe how absolute zero of temperature can be defined. *(2 marks)*
(ii) Use the kinetic theory of gases to explain the existence of absolute zero of temperature. *(5 marks)*

(c) A volume of 2500 cm^3 of hydrogen gas is collected at 67 ^{0}C at a pressure of 730 mm Hg. Calculate the volume of the gas at s.t.p. *(4 marks)*

(d) Smoke is confined in a smoke cell and observed through a microscope. Explain what is observed when the temperature of the smoke cell is raised. *(4 marks)*

5. (a) What is meant by *sound*? *(1 mark)*

(b) Describe an experiment to show that sound waves require a material medium for transmission. *(5 marks)*

(c) Explain briefly the following:

(i) a dog is more able than a human being to detect the presence of a thief tiptoeing at night. *(2 marks)*

(ii) an approaching train can easily be detected by human ears placed close to the rails. *(2 marks)*

(d) A sound of frequency 250 H_Z is produced 120 m away from a high wall. Calculate the

(i) wavelength, *(3 marks)*

(ii) time it takes the sound wave to travel to and from the wall.

(Speed of sound in air = $330\,ms^{-2}$) *(3 marks)*

6. (a) With the aid of a diagram explain, the use of *keepers* to store magnets. *(5 marks)*

(b) (i) Describe using a labelled diagram how a telephone receiver works. *(6 marks)*

(ii) State **two** ways by which the strength of an electromagnet can be increased. *(1 mark)*

(c) A bulb is rated 12.0 V, 36 W when used on a 12.0 V supply.

(i) How much current does it draw from the supply?

(ii) What is its resistance? *(4 marks)*

7. (a) (i) Draw a labeled diagram of a lead acid accumulator. *(2 marks)*

(ii) List **three** precautions necessary to prolong the life of an accumulator. *(3 marks)*

(iii) State **two** disadvantages of a **Nife** cell over a lead acid cell. *(2 marks)*

(b) What is meant by the following :

(i) electromotive force,

(ii) internal resistance, of a cell? *(2 marks)*

(c) A cell is connected in series with an ammeter and variable resistor. The potential difference, V, across the resistor varies with current I, supplied through the resistor as shown in the graph in Figure **2**. Use the graph to determine the

(i) e.m.f, *(2 marks)*

(ii) internal resistance, of the cell. *(5 marks)*

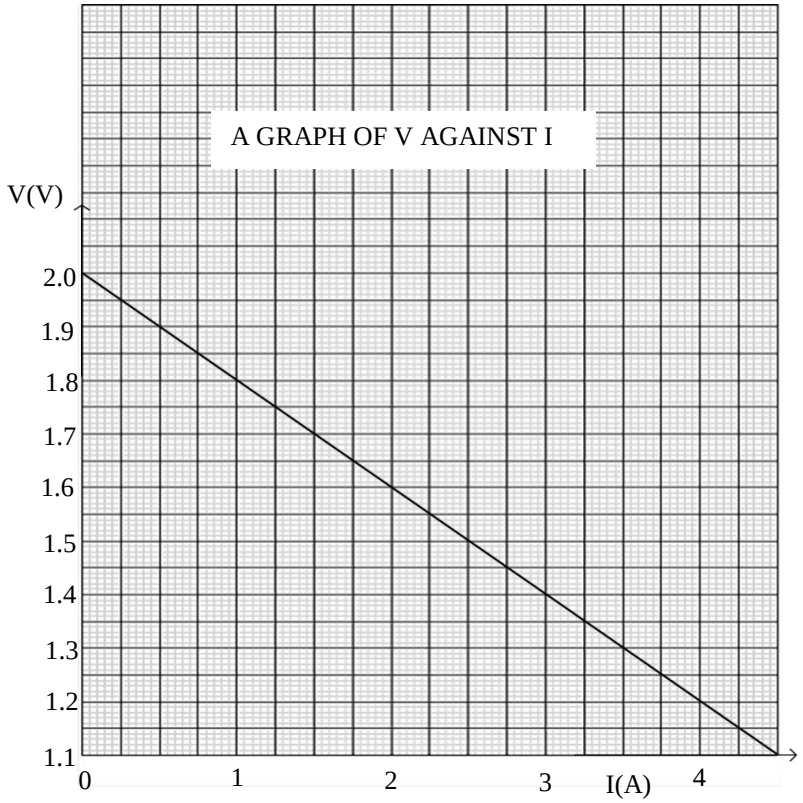


Figure **2**

8. (a) What is meant by the following:

   (i) thermionic emission, *(1 mark)*
   (ii) photo-electric effect? *(1 mark)*

   (b) (i) State the conditions necessary for photoelectric effect to take place. *(2 marks)*
   (ii) With the aid of a labelled diagram, describe how an alternating current can be fully rectified. *(7 marks)*

   (c) Explain how leakage of charge occurs at the ends of sharp conductors. *(5 marks)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2004
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt any **five** *questions.*

Mathematical tables, slide rules and silent non programmable calculators may be used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) Describe an experiment to estimate the thickness of an oil molecule. *(07 marks)*

(b) Explain the following observations:

(i) When mercury and water are separately poured on glass, mercury does not wet glass but water does. *(03 marks)*

(ii) When a detergent is added to a clean water surface, a needle floating on it (water surface) sinks. *(02 marks)*

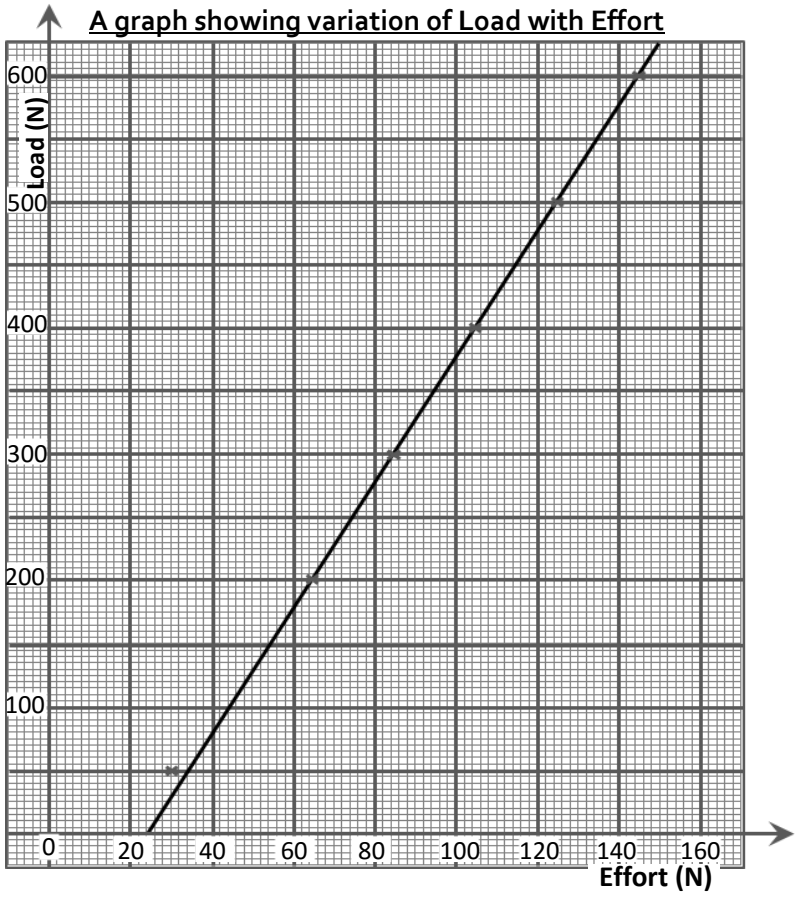
(c) A small steel ball is allowed to fall centrally down a tall cylinder containing lubricating oil.

(i) Sketch the velocity-time graph for the motion of the ball. *(01 mark)*

(ii) Describe the features of the graph. *(03 marks)*

2. (a) Define the term **velocity ratio** as applied to machines. *(01 mark)*

(b) The graph in Figure **1** shows how load varies with effort in an experiment using a single string pulley system of velocity ratio 5.



For a load of 450 N, find the

(i) effort. *(01 mark)*

(ii) mechanical advantage. *(03 marks)*

(iii) efficiency. *(03 marks)*

(c) A block and tackle pulley system has two pulleys in the lower block and three in the upper block.

(i) Sketch the diagram of this pulley system. *(02 marks)*

(ii) Sketch a graph showing the variation of mechanical advantage with load. *(02 marks)*

(iii) Explain why the efficiency of such a pulley system is less than 100%. *(02 marks)*

(d) Name any **two** uses of the type of pulley drawn in (c)(i). *(02 marks)*

3. (a) Define **specific latent heat of vaporization**. *(01 mark)*

(b) A calorimeter of 35.0 g and specific heat capacity 840 J kg $^{-1}$ K $^{-1}$ contains 143.0 g of water at 7 ^{0}C. Dry steam a 100 ^{0}C is bubbled through the water in the calorimeter until the temperature of the water rises to 29 ^{0}C. If the mass of steam which condenses is 5.6 g,

(i) calculate the heat gained by the water and the calorimeter. *(04 marks)*
(ii) obtain an expression for the heat lost by the steam in condensing at 100 ^{0}C and in cooling to 29 ^{0}C. *(03 marks)*
(iii) find the specific latent heat of vaporization of water. *(03 marks)*

(c) Explain, in terms of molecules, what is meant by a saturated vapour. *(02 marks)*

(d) Describe briefly one application of evaporation. *(03 marks)*

4. (a) (i) What is a **magnetic field**? *(01 mark)*
(ii) State the **law of magnetism**. *(01 mark)*

(b) (i) Explain with the aid of diagrams, how a steel bar can be magnetized by the single touch method. *(04 marks)*
(ii) Sketch the magnetic field pattern around two bar magnets whose north poles face each other. *(02 marks)*

(c) With the aid of a labelled diagram, describe how a simple a.c. generator works. *(08 marks)*

5. (a) What is meant by a **conductor** an **insulator**? Give an example of each. *(03 marks)*

(b) (i) Explain briefly how you can charge a conductor negatively by induction. *(05 marks)*
(ii) Describe how it can be confirmed that the conductor in (b) (i) is negatively charged. *(02 marks)*

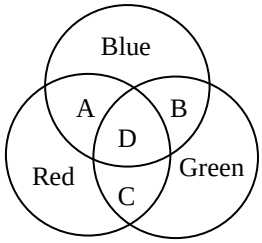
(c) Explain the action of a lightning conductor. *(06 marks)*

6. (a) Explain **dispersion** as applied to light. *(02 marks)*

(b) (i) What is a **pure spectrum**? *(01 mark)*
(ii) With the aid of a labelled diagram, describe briefly how a pure spectrum is produced. *(06 marks)*

(c) (i) Distinguish between a **primary** and a **secondary** colour. *(02 marks)*

(ii) Figure **2** shows colours mixed by addition. Name the colours represented by the parts labelled A, B,C and D.



(d) State the colour of a yellow dress in green light. *(01 mark)*

7. (a) (i) Define an **echo**. *(01 mark)*
(ii) State the conditions for a stationary wave to be formed. *(02 marks)*

(b) List the factors on which the frequency of a wave in a vibrating string depends. *(03 marks)*

(c) Describe an experiment to demonstrate **resonance** in a closed pipe. *(05 marks)*

(d) A child stands between two cliffs and makes a loud sound. If it hears the first echo after 1.5s and the second echo after2.0 s, find the distance between the two cliffs.
[Speed of sound in air = 320 ms $^{-1}$] *(05 marks)*

8. (a) (i) What is meant by **cathode rays**? *(01 mark)*

(ii) With the aid of a labelled diagram, describe how cathode rays are produced by thermionic effect. *(05 marks).*

(b) With reference to the cathode ray oscilloscope, describe:

(i) the function of the time-base. *(02 marks)*

(ii) how the brightness is regulated. *(02 marks)*

(c) A cathode ray oscilloscope (C.R.O) with time-base switched on is connected across a power supply. The wave form shown in Figure **3** is obtained.

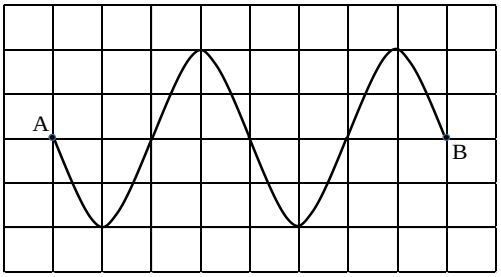


Figure **3**

The distance between each line is 1 cm.

(i) Identify the type of voltage generated by the power supply. *(01 mark)*

(ii) Find the amplitude of the voltage generated if the voltage gain is 5 V cm $^{-1}$. *(02 marks)*

(iii) Calculate the frequency of the power source if the time-base setting on the C.R.O is 5.0 x 10^{-3} s cm $^{-1}$. *(03 marks)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2005
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Mathematical tables, slide rules and silent non programmable calculators maybe used.

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Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) State **Hooke's law of elasticity**. *(01 mark)*

(b) Different loads, w, are applied to the end of an elastic wire and the corresponding extension, e, of the wire recorded.

(i) Sketch a labeled graph of e against w. *(03 marks)*
(ii) Describe briefly the features of the graph in (b) (i). *(02 marks)*

(c) A spring of natural length 5.0×10^{-2} m extends by 2.0×10^{-3} m when a force of 1.8 N acts on it. Calculate the extension when a force of 10N is applied to the spring. *(06marks)*

(d) Describe an experiment to demonstrate the existence of surface tension. *(04 marks)*

2. (a) (i) Describe the fixed points of a Celsius scale of temperature. *(02 marks)*
(ii) Give **two** advantages of mercury over alcohol as a thermometric liquid. *(02 marks)*
(iii) Convert -200^0C to Kelvins. *(01 mark)*

(b) Use the kinetic theory to explain the following:

(i) cooling by evaporation. *(05 marks)*
(ii) Why the temperature of a gas contained in a cylinder increases when it is compressed. *(03 marks)*

(c) Explain briefly the transfer of thermal energy by conduction in metals. *(02 marks)*

3.

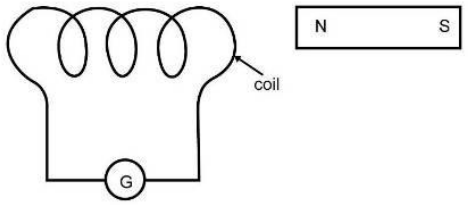

Figure **1**

(a) A cable is connected to a centre-zero galvanometer, G, as shown in figure**1**.

(i) State what is observed when the **N**- pole of a bar magnet is moved towards the cable. *(01 mark)*
(ii) State **two** ways in which the effect observed in (a) (i) can be increased. *(02 marks)*

(b) (i) With the aid of a labeled diagram describe how a simple a.c. generator works. *(05 marks)*
(ii) Sketch the variation of the voltage from an a.c. generator and use it to define the terms **peak value** and **period**. *(04 marks)*

(c) With the aid of a labelled diagram, describe how full wave rectification can be obtained using four diodes. *(04 marks)*

4. (a) Describe how you would use a gold leaf electroscope to determine the sign of the charge on a given charged body. *(05 marks)*

(c) Explain how an insulator gets charged by rubbing. *(03marks)*

(d) Sketch the electric field pattern between a charged point and a metal plate. *(02 marks)*

(e) Describe how a lightning conductor safeguards a tall building from being struck by lightning. *(06marks)*

5. (a) (i) State the principle of conservation of energy. *(01 mark)*
(ii) Illustrate the principle in (a) (i) with reference to a simple pendulum in a vacuum. *(04 marks)*

(b) A ball of mass 0.30 kg falls from rest at a height of 4.0 m onto a horizontal surface and rebounds to a height of 2.0 m.

(i) Find the kinetic energy just before the ball hits the surface; and just after the collision. Explain the difference between the two energies. *(06marks)*

(ii) What is its initial momentum? *(05 marks)*

6. (a) State any **two** differences between sound and light waves. *(02 marks)*

(i) Describe a simple experiment to determine the velocity of sound in air. *(04marks)*

(ii) Explain why the speed of sound is higher in solids than in air. *(03 marks)*

(b) Two people X and Y stand in a line at distances of 330 m and 660 m respectively from a high wall. Find the time interval taken for X to hear the first and second sounds when Y makes a loud sound.
(Speed of sound in air = 330 ms^{-1}) *(03 marks)*

(c) (i) What is meant by a **stationary wave**? *(01 mark)*

(ii) Give any **two** conditions. *(02 marks)*

(iii) Name **one** musical instrument which produces stationary waves. *(01mark)*

7. (a) Explain with the aid of a ray diagram, the formation of umbra and penumbra. *(06 marks)*

(b) Draw a ray diagram to show the action of a converging lens as a magnifying glass. *(02 marks)*

(c) (i) State any **three** effects of electromagnetic radiation on matter. *(03 marks)*

(ii) State two properties that electromagnetic waves have in common. *(02 marks)*

(d) A radio wave of wavelength 330 m is transmitted at a frequency of 908 kHz. Find its velocity. *(03 marks)*

8. (a) Draw a labelled diagram to show the main bands of the electromagnetic spectrum. *(03 marks)*

(b) (i) With the aid of a labelled diagram, describe how x-rays are produced in an x-ray tube. *(08 marks)*

(ii) State **two** applications of x-rays. *(02 marks)*

(c) The half–life of a radioactive substance is 3 h. Find how long it takes for the mass of the substance to reduce to one-quarter of its original mass. *(03 marks)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2006
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Velocity of electromagnetic waves	=	3.0 x 10^8 ms^{-1}

1. (a) State **Newton's laws of motion**. *(03 marks)*

(b) A block of mass 50 kg is pulled from rest along a horizontal surface by a rope tied to one face of the block as shown in Figure **1**.

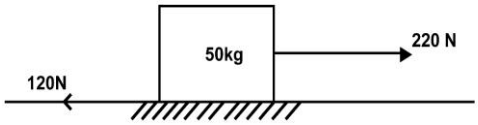

Figure **1**

The tension in the rope is 220 N. The frictional force between the block and the horizontal surface is 120 N.

(i) Find the acceleration of the block. *(03 marks)*
(ii) Calculate the distance moved by the block in 4.0 s. *(02 marks)*
(iii) What is the reaction of the surface on the block? *(02marks)*
(iv) Compare the work done by the tension in the tension in the rope during the 4.0 s interval with kinetic energy gained. *(06 marks)*

2. (a) What is meant by **pressure**? *(01 mark)*

(b) (i) Explain why one feels more pain when pricked with a needle than when pricked with a nail. *(05 marks)*
(ii) State the **assumption made**. *(01 mark)*

(c) With the aid of a labeled diagram, explain how a force pump works. *(06 marks)*

(d) Calculate the pressure exerted on the ground by a box of mass 10 kg when corresponding area of contact is 2 m^2 *(03 marks)*

3. (a) Distinguish between **angle of dip (inclination)** and **angle of declination**. *(03 marks)*

(b) Draw a diagram to show the magnetic field pattern around a bar magnet placed in the earth's field with the north pole of the magnet pointing to the earth's magnetic south. *(03 marks)*

(c) (i) What is an **electromagnet**? *(01 mark)*
(ii) Describe with the aid of a labeled diagram how an electric bell works. *(06 marks)*

(d)

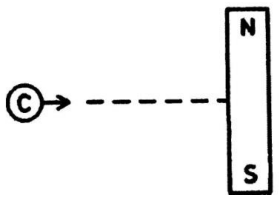

Figure **2**

Describe what happens to the compass needle, C, as it is moved closer to the bar magnet along the dotted line shown in figure **2**. *(03 marks)*

4. (a) Define the following terms:

(i) the volt, *(01 mark)*
(ii) electrical resistance. *(01 mark)*

(b) List ways by which the life of an accumulator can be prolonged. *(03 marks)*

(c)

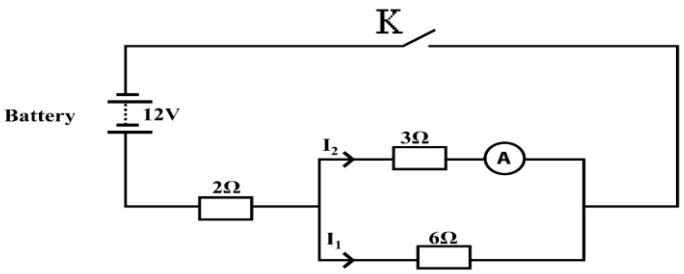

Figure **3**

A battery of e.m.f 12 V and negligible internal resistance is connected to resistances 2**Ω**, 3 **Ω** and 6**Ω** as shown in figure **3**. Find the reading of the ammeter, A, when K is closed. *(07 marks)*

(d) State **three** advantages of an alternating current over a direct current in power transmission. *(03marks)*

(e) Sketch the current versus voltage variation for a semiconductor diode. *(01mark)*

5. (a) Define the following terms as applied to waves:

(i) **amplitude**, *(01 mark)*
(ii) **frequency**. *(01 mark)*

(b) (i) What is meant by **interference of waves**? *(02 marks)*
(ii) Using a labeled diagram, show how circular water waves are reflected from a straight barrier. *(03 marks)*

(c) (i) Use a labeled diagram to show the bands of an electromagnetic spectrum. *(03 marks)*
(ii) Calculate the frequency of a radio wave of wavelength 2 m. *(03 marks)*

(d) With the aid of a diagram, show dispersion of white light by a prism. *(03 marks)*

6. (a) (i) Distinguish between **nuclear fusion** and **nuclear fission.** *(02 marks)*
(ii) State **one** example where nuclear fusion occurs naturally. *(01 mark)*

(b) State **one** use of nuclear fission. *(01 mark)*

(c) The following nuclear reaction takes place when a neutron bombards a sulphur atom.

$$^{34}_{16}S + {}^{1}_{0}n \rightarrow {}^{a}_{b}Y$$

(i) Describe the composition of the nuclide, *Y*, formed. *(02 marks)*
(ii) The nuclide, *Y*, decays by emission of an***α***-particle and a ***γ***-ray. Find the changes in mass number and atomic number of the nuclide. *(02 marks)*
(iii) State **two** properties of ***α***- particles. *(02 marks)*

(d) The half-life of the isotope cobalt-60 is **five** years. What fraction of the isotope remains after 15 years? *(03 marks)*

(e) State:

(i) **one** medical use of radioisotopes. *(01 mark)*
(ii) **two** ways of minimizing the hazardous effects of radiation from radioactive materials. *(02 marks)*

7. (a) Explain the term **virtual image** as applied to optics. *(03 marks)*

(b) With aid of a ray diagram, explain why a convex mirror is used as a driving mirror. *(05 marks)*

(c) An object is placed 15.0 cm in front of a concave mirror. An upright image of magnification **four** is produced. By graphical method, determine the:

(i) nature of the image.
(ii) focal length of the mirror
(iii) distance of the image from the mirror. *(06 marks)*

(d) Name **two** applications of a concave mirror. *(02 marks)*

8. (a) (i) Define **latent heat of fusion**. *(01 mark)*

(ii) Describe with aid of a labeled diagram, an experiment to show the effect of increase in pressure on the melting point of ice. *(04 marks)*

(iii) If the melting point of lead is 327 ^{0}C, find the amount of heat required to melt 200 g of lead initially at 27 ^{0}C. *(04 marks)*

[Specific heat capacity of lead is 140 J kg $^{-1}$ K^{-1}
Specific latent heat of fusion of lead is 2.7 x 10^5 J kg $^{-1}$]

(b) What is meant by the terms:

(i) **temperature**,
(ii) **heat**? *(02 marks)*

(c) The fundamental interval of mercury in glass is 192 mm. Find the temperature in degrees Celsius when the mercury thread is 67.2 mm long. *(03 marks)*

(d) State two physical properties which change with temperature. *(02 marks)*

END

Name …… Centre and Index No. ……../ ……..

Signature …….

535/2
PHYSICS
Paper 2
Oct. / Nov.2007
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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Specific heat capacity of copper = 400 J kg^{-1} K^{-1}

Specific latent heat of fusion of water = 340000 J kg^{-1}

Speed of sound in air = 320 m s^{-1}

1. (a) What is meant by

(i) velocity ratio of a machine? *(01 mark)*
(ii) pitch of a screw? *(01 mark)*

(b) A screw jack with a lever arm of 56 cm and a pitch of 2.5 mm is used to raise a load of 800 N. If its efficiency is 25%, find

(i) the velocity ratio. *(04 marks)*
(ii) mechanical advantage. *(03 marks)*

(c) Describe an experiment to show how the mechanical advantage of a block and tackle pulley system with velocity ratio 4 varies with the load. *(07 marks)*

2. (a) What is the **absolute zero temperature**? *(01 mark)*

(b) Explain, using the kinetic theory, why the pressure of air inside a car tyre increases on a hot day. *(03 marks)*

(c) Describe with the aid of a labelled diagram an experiment to investigate the effect of temperature on the volume of a fixed mass of a gas at constant pressure. *(08 marks)*

(d) The same quantity of heat was supplied to 5.0 kg of sea water and 12.0 kg of methylated spirit. The temperature rise was 3.0 ^{0}C and 2.0 ^{0}C respectively. Find the ratio of the specific heat capacity of sea water to that of methylated spirit. *(04 marks)*

3. (a) (i) Explain what is meant by polarization as applied to a simple cell. *(03 marks)*
(ii) State how polarization can be minimized in a simple cell. *(01 mark)*

(b) Explain how the life of a lead-acid accumulator may be prolonged. *(06 marks)*

(c)

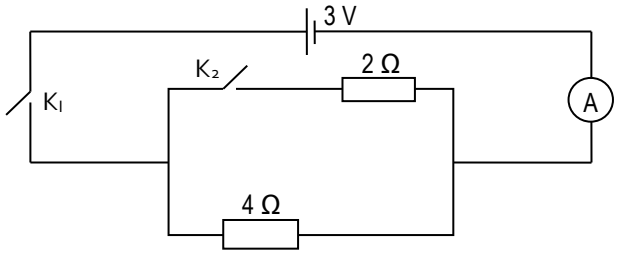

Figure **1**

What will be the reading of the ammeter in Figure **1** if switch $K_2$is

(i) open and K_1 closed? *(02 marks)*
(ii) closed and K_1 closed? *(04 marks)*

4. (a) State the **laws of reflection**. *(02 marks)*

(b) Describe a simple experiment to demonstrate the principle of reversibility of light. *(05 marks)*

(c) An object is released from a height of 10 m above a plane mirror. What distance must it drop through in order to be 5 m away from its image? *(02 marks)*

(d)

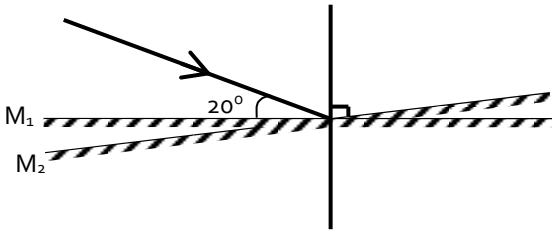

Figure **2**

An incident ray makes an angle of 20^o with a plane mirror in position M_1, as shown in Figure **2**.

What will be the angle of reflection, if the mirror is rotated through 6^{o} to position M_2 while the direction of the incident ray remains the same? *(03 marks)*

(e) With the aid of a ray diagram, explain how a thick plane mirror for forms multiple images of an object. *(04 marks)*

5. (a) (i) Define **moment of a force**. *(01 mark)*
(ii) State the **principle of moments**. *(01 mark)*

(b) Describe an experiment to determine the mass of an object using a metre rule and a single known mass. *(07 marks)*

(c)

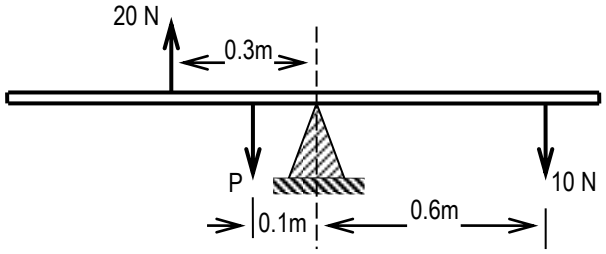

Figure **3**

Forces of 20 N, 10 N and P act on a uniform rod pivoted at its centre as shown in figure **3**. Find the magnitude of P if the system is in equilibrium. *(03 marks)*

(d) (i) State **two** applications of the principle of moments. *(02 marks)*
(ii) Draw a diagram to show the forces acting on an object resting on a table. *(02 marks)*

6. (a) Define the term **constructive interference** as applied to sound waves. *(01 mark)*

(b)

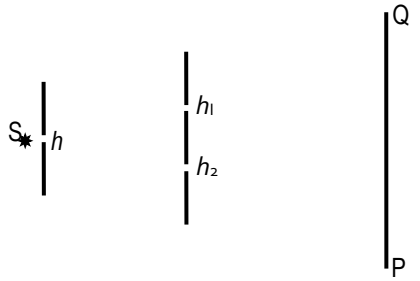

Figure **4**

Figure **4** shows a source of sound S behind a barrier with a single hole, *h*, placed behind another barrier with two identical holes h_1 and h_2. A sound detector is moved along a line PQ.

(i) With the aid of a diagram explain what is detected. *(05 marks)*
(ii) What is the significance of h_1 and h_2? *(02 marks)*

(c)

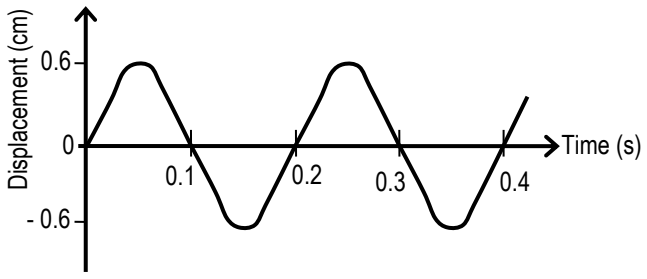

Figure **5**

Figure **5** shows the displacement-time graph of a wave travelling through water with a velocity of 2.5 mms $^{-1}$. Find the

(i) amplitude, *(01 mark)*
(ii) period, *(01 mark)*
(iii) wavelength of the wave. *(03 marks)*

(d) What are the conditions for formations of a standing wave with the wave in (c) above? *(03 marks)*

7. (a) What is meant by a **magnetic field**? *(01 mark)*

(b) Explain with the aid of a diagram what happens when two vertical, parallel conductors are placed near one another and carry current in

(i) the same direction. *(03 marks)*
(ii) opposite direction. *(03 marks)*

(c) (i) Describe with the aid of a diagram, how a direct current generator works. *(06 marks)*

(ii) State three ways of increasing the e.m.f produced by the generator. *(03 marks)*

8. (a) What are **X-rays**? *(01 mark)*

(b) With the aid of a labelled diagram, describe the structure and operation of an X-ray tube. *(07 marks)*

(c) Explain briefly how each of the following can be increased in an X-ray tube:

(i) intensity of X-rays. *(02 marks)*
(ii) penetrating power of X-rays. *(02 marks)*

(d) State **four** ways in which X-rays are similar to gamma rays. *(02 marks)*

(e) Give **two** biological uses of X-rays. *(02 marks)*

END

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Signature …….

535/2
PHYSICS
Paper 2
Oct. / Nov.2008
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer any **five** *questions.*

Mathematical tables, slide rules and non-programmable calculators may be used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}

1. (a) Group the following quantities into scalars or vectors; **temperature, momentum, time** and **acceleration**. *(02 marks)*

(b) The graph in Figure 1 represents variation of velocity with time of two athletes A and B.

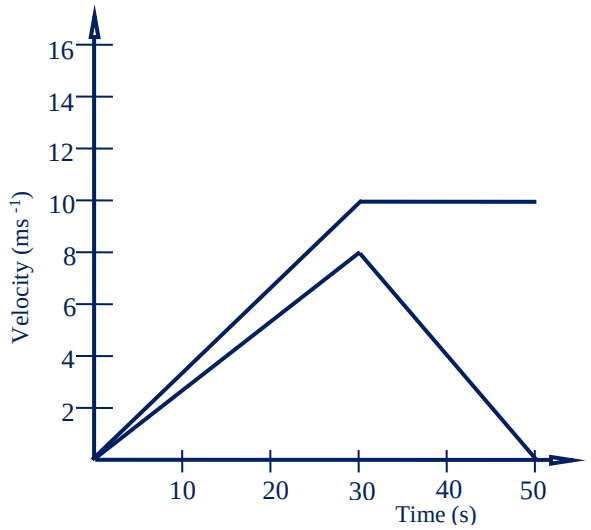

Figure.**1**

(i) Describe the motion of A and B. *(05 marks)*
(ii) What distance was covered by B in 50 s? *(03 marks)*

(c) A stone of mass 100 g is thrown vertically upwards with a force of 5 N. What is its initial acceleration? *(04 marks)*

(d) Describe what happens when air is blown into a balloon and the balloon released. *(02 marks)*

2. (a) Distinguish between **specific heat capacity** and **heat capacity**. *(02 marks)*
(b) Explain how a hot object standing on a metallic table on the surface of the moon loses heat. *(04 marks)*
(c) Outline the steps and precautions needed in measuring the specific heat capacity of a liquid by method of mixtures. *(07 marks)*

(d) The $0^{o}C$ and $100^{o}C$ marks on a liquid-glass thermometer are 10 cm apart. What would be the temperature if the liquid fell 2 cm below the $0^{o}C$ mark? *(03 marks)*

3. (a) Define the following terms as applied to magnetism:

(i) Ferromagnetic material, *(01 mark)*
(ii) Neutral point. *(01 mark)*

(b) Sketch the magnetic field pattern around a

(i) bar magnet whose axis lies along the magnetic north. *(02 marks)*
(ii) circular current carrying coil. *(02 marks)*

(c) With the aid of a labelled diagram, explain how an electric bell works. *(07 marks)*

(d) (i) What is meant by a magnetically saturated material? *(02 marks)*
(ii) State **one** method of demagnetizing a magnet. *(01mark)*

4. A student set up the circuit in Figure 2 to determine the maximum current which can be taken by a fuse wire.

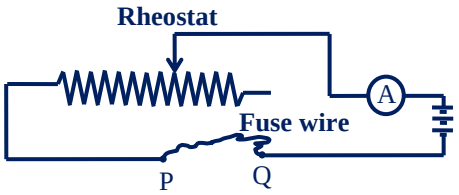

Figure **2**

(a) Describe briefly how this circuit could be used to determine the maximum current. *(03 marks)*

(b) Explain what would happen if

(i) two strands of the fuse wire were connected in parallel across *P* and *Q*. *(03 marks)*
(ii) the length of the wire were doubled. *(03 marks)*

(c) An electric fire, a lamp and electric drill rated at 2000 W, 100 W and 300 W respectively are connected in parallel across a 240 V mains. Find the

(i) power taken from the mains. *(01 mark)*
(ii) current supplied by the mains. *(03 marks)*
(iii) cost of running these appliances for 12 h if one unit costs Shs. 200. *(03 marks)*

5. (a) Define **density** and state its SI unit. *(02 marks)*

(b) With the aid of a labelled diagram, describe the motion of a ball bearing which is dropped centrally into a tall jar containing oil. *(04 marks)*

(c) (i) State **Archimedes' principle**. *(01 mark)*
(ii) An object weighs 30 N in air and 20 N when immersed in water of density 1000 kg m^{-3}. If the same object weighs 22 N when immersed in methylated spirit, what is the density of the spirit? *(05 marks)*

(d) Explain why a ship is able to float on water in spite of being made of metal. *(04 marks)*

6. (a) State the changes detected when listening to a sound note if the

(i) amplitude is raised. *(01 mark)*
(ii) frequency is increased. *(01 mark)*

(b) Give **three** differences between light waves and sound waves. *(03 marks)*

(c)

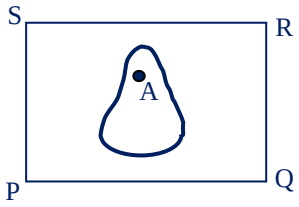

Figure **3**

Figure 3 shows a ripple tank PQRS whose one side is raised. A ripple started by touching the water at A, and after one second it had the shape shown.

(i) State which is the tank raised. *(01 mark)*
(ii) Explain the shape of the ripple. *(04 marks)*

(d)

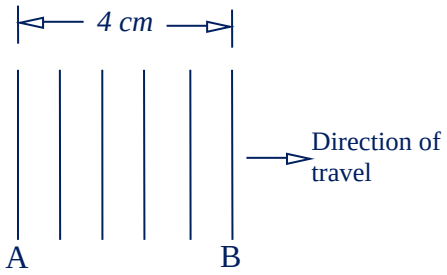

Figure **4**

The line in Figure 4 show crests of straight ripples formed in a ripple tank.

(i) If after 10 seconds A is in position B, calculate the velocity of the ripples. *(04 marks)*

(ii) Draw a diagram showing how the ripples would pass through a wide gap of an obstacle they would meet. *(02 marks)*

7. (a) What is meant by a **light ray**? *(01 mark)*

(b) With the aid of a labelled diagram, describe the structure and working of a simple lens camera. *(06 marks)*

(c) State **two** differences between the human eye and the lens camera. *(02 marks)*

(d) (i) State the **laws of refraction**. *(02 marks)*

(ii)

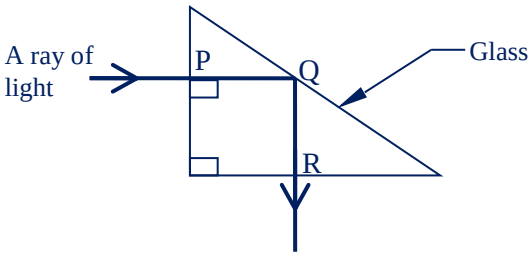

Figure **5**

Figure 5 shows a ray of light incident on a right angled prism of refractive index 1.5. Explain why the ray of light follows the path shown. *(05 marks)*

8. (a) (i) What are **cathode rays**? *(01 mark)*

(ii) State **two** differences between gamma rays and cathode rays. *(02 marks)*

(b) Describe a simple experiment to distinguish the three radiations that are emitted by radioactive materials. *(04 marks)*

(c) A radioactive element has a half-life of 4 minutes. Given that the original count rate is 256 counts per minute,

(i) find the time taken to reach a count rate of 16 counts per minute. *(04 marks)*

(ii) what fraction of the original number of atoms will be left by the time the count rate is 16 counts per minute? *(01 mark)*

(d) (i) Which of the following belongs to the same element:

$$^{24}_{11}X,\ ^{24}_{12}Y,\ ^{24}_{11}Z\ ?$$ *(02 marks)*

(ii) What is **nuclear fusion**? *(01 mark)*

535/2
PHYSICS
Paper 2
Oct. / Nov.2009
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Mathematical tables and silent non programmable calculators may be used.

These values of physical quantities may be useful to you.

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Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Velocity of electromagnetic waves	=	3.0 x 10^{8} m s^{-1}

1. (a) State the

(i) law of conservation of moment. *(01 mark)*
(ii) factors on which linear momentum depends. *(01 mark)*

(b) Explain what happens when a balloon is filled with air and then released in space without tying its open end. *(04 marks)*

(c) Explain what happens to a passenger in a bus ,when the driver brakes suddenly. *(02 marks)*

(d) Define the following terms:

(i) Displacement. *(01 mark)*
(ii) Force. *(01 mark)*

(e) With the aid of a labeled diagram, describe an experiment to measure a uniform velocity of a body using a ticker timer. *(06 marks)*

2. (a) Define a **moment of force**. *(01 mark)*

(b) Describe an experiment to determine the mass of a uniform meter rule using the principle of moments. *(05 marks)*

(c)

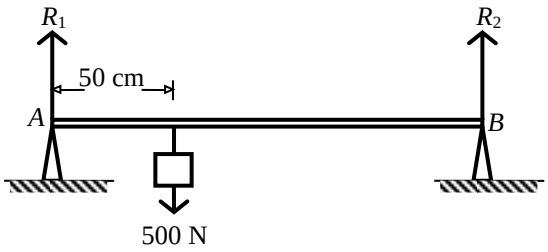

Figure **1**

Figure 1 shows a uniform pole *AB* of length 2m and weight 50N supported at the ends *A* and *B*. A load of weight 500 N is suspended at a point 50cm from *A*.
Calculate the reaction forces R_1 and R_2 at the supports. *(06 marks)*

(d) (i) Explain what is meant by unstable equilibrium. *(02 marks)*
(ii) State **two** ways of increasing the stability of a body. *(02 marks)*

3 (a) Define the following terms;

(i) Strain. *(01 mark)*
(ii) Tensile force. *(01 mark)*

(b) With the aid of a diagram, describe an experiment to verify Hooke's law using a spring. *(06 marks)*

(c) Explain why tea cups are usually made of clay material and **not** metals. *(04 marks)*

(d) (i) A material of mass 2kg requires 4.4×10^3 J for its temperature to change from 60^0C to 80^0C . Calculate its specific heat capacity. *(03 marks)*
(ii) If the material in (d) (i) is placed in a vacuum, state why it cools. *(01 marks)*

4. (a) Describe with the aid of a labelled diagram the operation of a transformer. *(05 marks)*
(b) A 240 V step-down mains transformer is designed to light **ten** 12V, 20 W ray box lamps and draws a current of 1A in the primary coil. Calculate the:

(i) Power supplied to the primary coil. *(02 marks)*
(ii) Power developed in the secondary coil. *(01 mark)*
(iii) Efficiency of the transformer *(02 marks)*

(c) With the aid of suitable diagrams, distinguish between an alternating current and a direct current. *(04 marks)*

(d) Explain how a fuse as a safety device achieves its function in house wiring. *(02 marks)*

5. (a) Distinguish between thermionic and photoelectric emission. *(02 marks)*

(b)

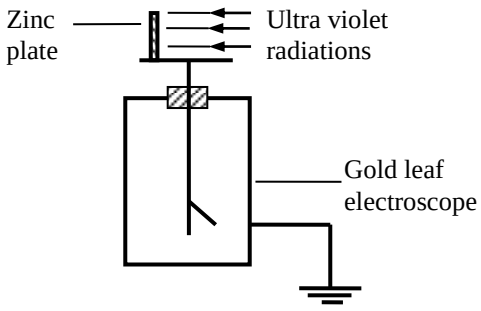

Figure **2**

Ultra violet radiations is incident on a clean zinc plate resting on the cap of a charged gold leaf electroscope as shown in Figure 2. Explain what is observed if:

(i) the gold leaf electroscope is positively charged. *(03 marks)*
(ii) radio waves is used instead of ultra violet radiations. *(03 marks)*

(c) (i) With the aid of a labeled diagram, describe how X-rays are produced in an *X*-ray tube. *(05 marks)*
(ii) Explain why soft *X*-rays are used instead of hard *X*-rays to take photographs of internal parts of a patient in hospitals. *(03 marks)*

6. (a) Define the terms:

(i) amplitude. *(01 mark)*
(ii) wavelength. *(01 mark)*

(b) Draw diagrams to show how circular water ripples are reflected from

(i) concave reflector. *(02 marks)*
(ii) convex reflector. *(02 marks)*

(c) (i) Distinguish between longitudinal waves and transverse waves. *(02 marks)*
(ii) Give **one** example of each of the waves in (c) (i). *(01 mark)*

(d) State **four** properties of electromagnetic waves. *(02 marks)*

(e) The distance between two successive antinodes on a standing wave is 3.0 cm. If the distance between the source of wave and reflector is 24.0cm, find the

(i) number of loops. *(03 marks)*
(ii) wavelength of the wave. *(02 marks)*

7. (a) Define the following terms as applied to curved mirrors:

(i) center of curvature. *(01 mark)*
(ii) principal axis. *(01 mark)*

(b) Explain with the aid of ray diagrams, why a parabolic mirror is preferred to a concave mirror as a car head lamp. *(04 marks)*

(c) An object of height 5 cm is placed 15 cm in front of a concave mirror of radius of curvature 20cm. By scale drawing, find the

(i) image distance from the mirror.
(ii) height of the image. *(05 marks)*

(d) (i) With the aid of ray diagrams, explain how regular and diffuse reflections are produced. *(03 marks)*

(ii) State the characteristics of images formed in plane mirrors. *(02 marks)*

8. (a) What is meant by

(i) radioactivity? *(01 mark)*
(ii) half life? *(01 mark)*

(b) What happens to the activity of a radioactive material when its

(i) mass is increased. *(02 marks)*
(ii) temperature is increased. *(02 marks)*

(c) A material is wrapped in a photographic film and kept in a dark room When the photographic film is removed, it is found to be darkened.

(i) Identify the material. *(01 mark)*
(ii) Explain the observation. *(03 marks)*

(d). A radioactive substance of mass 60 g takes 400 years for its mass to be reduced to 15g. Find its half life. *(03 marks)*

(e) State:

(i) **two** industrial and **two** medical uses of radioactivity. *(02 marks)*
(ii) **two** health hazards of radioactivity. *(01 mark)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2010
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Density of water	=	1000 kg m^{-3}

1. (a) (i) State Newton's laws of motion. *(03 marks)*

(ii) Explain what happens to a person seated in a vehicle when it is suddenly brought to rest. *(02 marks)*

(b) Explain what happens to a parachutist who jumps from a high flying plane. *(04 marks)*

(c) Figure 1 shows a velocity -time graph for a vehicle in motion.

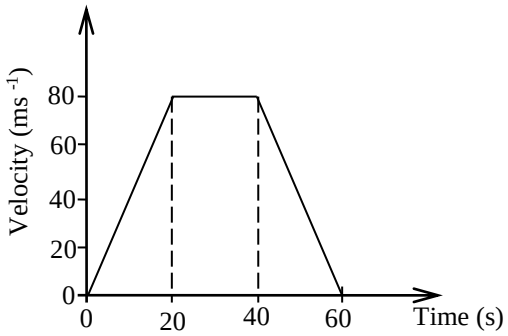

Figure **1**

(i) Find the total distance the vehicle moved. *(04 marks)*

(ii) Calculate the retardation of the vehicle. *(03 marks)*

2. (a) State the following.

(i) Archimedes principle *(01 mark)*

(ii) The law of floatation. *(01 mark)*

(b) A wooden sphere of mass 6 kg and volume $0.02m^3$ floats on water. Calculate the

(i) volume of the sphere below the surface of water. *(04 marks)*

(ii) density of the wood. *(02 marks)*

(iii) fraction of the volume of the sphere that would be submerged it floats in a liquid of density $800kgm^{-3}$. *(02 marks)*

(c) Explain why a cork stopper held below the surface of water rises when released. *(02 marks)*

(d) Describe an experiment to measure atmospheric pressure. *(04 marks)*

3. (a) Define the following

(i) **Hard magnetic material**. *(01 mark)*

(ii) **Soft magnetic material**. *(01 mark)*

(b) (i) Describe the electrical method of magnetizing a steel bar. *(05 marks)*

(ii) State any **two** ways of demagnetizing a bar magnet. *(01 mark)*

(c) Sketch the magnetic field pattern around a bar magnet with its S-pole pointing north in the earth's field. *(02 marks)*

(d) A stiff wire AB is held between opposite poles of two bar magnets and connected to a center-zero galvanometer as shown in Figure **2**.

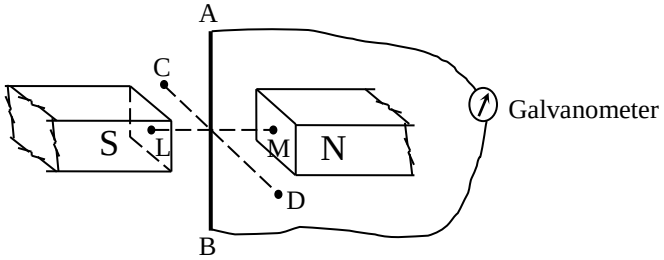

Figure **2**

The wire *AB* is kept vertical and moved horizontally along the line *CD*.

(i) Explain what is observed on the galvanometer as the wire AB moves toward *C* and toward *D*. *(04 marks)*

(ii) Explain what would be observed if the wire was moved along LM. *(02 marks)*

4 (a) (i) What is meant by **focal length of a lens**? *(01 mark)*

(ii) Calculate the power of a concave lens focal length 20cm. *(02 marks)*

(b) An object of height 7.5 cm is placed at a distance of 15cm from a convex lens of focal length 20cm. by scale drawing determine the

(i) height of the image

(ii) image distance

(iii) linear magnification. *(06 marks)*

(c) Describe an experiment to determine the focal length of a convex lens using an illuminated object and a plane mirror. *(05 marks)*

(d) What is the main difference between the operation of a lens camera and that of a human eye? *(02 marks)*

5. (a) (i) What is meant by the term **diffusion**? *(01 mark)*

(ii) Explain what is observed when smoke enclosed in an illuminated transparent cell is viewed through a microscope. *(02 marks)*

(iii) State what is observed in (a) (ii) when the cell is placed on ice blocks. Give a reason for your answer. *(02 marks)*

(b) (i) Describe an experiment to determine the thickness of an oil molecule. *(05 marks)*

(ii) State any assumption(s) made in (b) (i). *(02 marks)*

(c) (i) State **Hooke's law**. *(01 mark)*

(ii) When a boy of 50kg stands at the end of a spring board, it is depressed by 15cm. What would be the depression of the spring board when a man of 80kg stands at the end. *(03 marks)*

6. (a) What is meant by **thermionic emission**? *(01 mark)*

(b) (i) Name the three main components of a cathode ray oscilloscope (CRO). *(03 marks)*

(ii) Describe the functions of each component you have named in (b) (i). *(06 marks)*

(iii) Give two uses of a C.R.O. *(02 marks)*

(c) State the conditions under which electrons can be used to generate X-rays. *(03 marks)*

(d) Give one use of X-rays. *(01 mark)*

7. (a) (i) What is meant by **electromotive force**. *(01 mark)*

(ii) A dry cell supplies a current of 1.2A through two 2Ω resistors connected in parallel. When the resistors are connected in series, the current flowing in the circuit is 0.4A. Find the electromotive force. *(06 marks)*

(b) An electric lamp is rated 12V, 24W.

(i) Explain what is meant by this statement. *(01 mark)*

(ii) How much current does the lamp draw when connected across a 12V supply? *(02 marks)*

(c) With the aid of a labelled diagram, describe how four semi -conductor diodes may be used for full wave rectification. *(06 marks)*

8. (a) Define the following as applied to wave motions:

(i) **Frequency**. *(01 mark)*

(ii) **Wave length**. *(01 mark)*

(b) What are **transverse waves**? *(01 mark)*

(c) A radio station transmits signals at a frequency of 103.7 MHz. find the wave length of the signals and state any assumption made. *(02 marks)*

(d) Draw a diagram to show the pattern for a straight water wave passing through a narrow slit. *(02 marks)*

(e) Describe an experiment to demonstrate that sound waves require a material medium for their propagation. *(06 marks)*

(f) Explain how sound waves travel through air. *(03 marks)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2011
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Density of water	=	1000 kg m^{-3}

1. (a) State the conditions for a body to be in

(i) stable equilibrium. *(01 mark)*
(ii) neutral equilibrium. *(01 mark)*

(b) Explain why bus passengers' luggage is loaded in the boots rather than the rack on the top of the bus. *(04 marks)*

(c) A block of wood floats on both liquid *X* and liquid *Y*, but with a greater portion inside liquid *Y* than in *X*. Explain this observation. *(04 marks)*

(d) If a block of wood of volume 280 cm ^{3} floats on water with $\frac{3}{4}$ of its volume immersed, find the

(i) mass of the wooden block. *(03 marks)*
(ii) fraction of the block that sinks when it is placed in cooking oil of density 0.84 g cm $^{-3}$. *(03marks)*

2. (a) (i) Distinguish between **scalar** and **vector** quantities. *(01mark)*
(ii) Give **one** example of each quantity. *(01 mark)*

(b) Four forces of 2 N, 5 N, 10 N and 20 N act on a doll as shown in figure **1**.

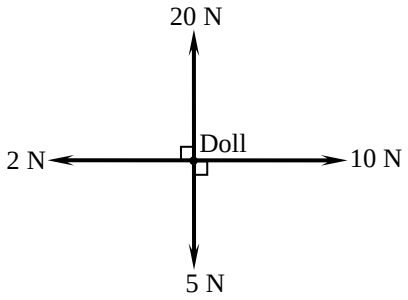

Figure **1**.

Find the magnitude of the resultant force acting on the doll. *(03 marks)*

(c) State **Newton's laws of motion**. *(03 marks)*

(d) Explain why passengers in a vehicle need to fasten their seat-belts. *(03 marks)*

(e) A bullet of mass 0.006 kg travelling at 120 m s $^{-1}$ penetrates deeply into a fixed target and is brought to rest in 0.01 s. Calculate the

(i) distance of penetration of the bullet. *(02 marks)*
(ii) average retarding force on the bullet. *(03 marks)*

3. (a) The diagram in figure **2** shows a car crossing a bridge made of a beam.

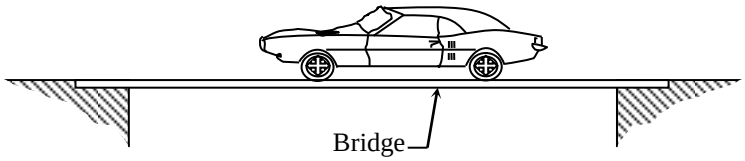

Figure **2**

Explain the mechanical state of the beam. *(04 marks)*

(b) What would be the effect on the beam in (a) above if a notch is made on the

(i) upper side? *(01 mark)*
(ii) lower side? *(01 mark)*

(c) (i) State **Hooke's law**. *(01 mark)*

(ii) Describe an experiment to verify Hooke's law using a spring. *05 marks)*

(d) (i) What is meant by the term **elasticity**? *(01 mark)*

(ii) A spring produces an extension of 6 mm when a load of 9 N is hanged from its free end. What load would cause the same spring to stretch by 16 mm? *(03 marks)*

4. (a) What is meant by the following as applied to sound waves?

(i) Pitch, *(01 mark)*

(ii) Audio-range. *(01 mark)*

(b) Figure **3** shows parallel sound waves travelling from a region of cold air to a region of hot air.

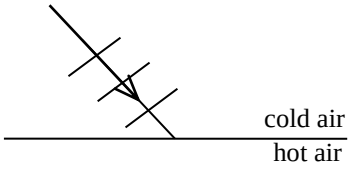

Figure **3**

(i) Copy and draw the waves' pattern in the hot air, showing the direction of travel. *(02 marks)*

(ii) Name the wave phenomenon shown by the wave. *(01 mark)*

(iii) Explain why the waves behaves the way you have drawn in the hot air. *(03 marks)*

(c) A student observed the time interval between lightning flash from a distant storm and the accompanying thunder as 4 beats of his pulse. Determine the:

(i) time in seconds taken for him to hear the thunder from the instant he sees the flash. *(03 marks)*

(ii) distance of the storm from the observer. *(03 marks)*
(Take the speed of sound in air = 330 m s $^{-1}$)

(d) Give any **two** applications of ultrasonic sounds. *(02 marks)*

5. (a) What is meant by **refraction of light**? *(01 mark)*

(b) When does total internal refraction occur? *(02 marks)*

(c) (i) Figure **4** shows a light ray through a right angled isosceles prism of refractive index 1.5.

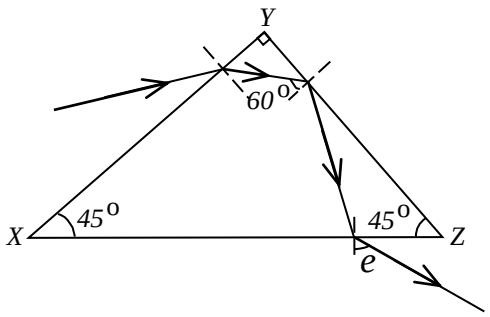

Figure **4**

If the ray is incident on face *YZ* at an angle of 60^{o}, find the angle of emergence, *e*. *(05 marks)*

(ii) State two reasons why reflecting prisms are better reflectors than plane mirrors. *(02 marks)*

(d) Describe an experiment to determine the refractive index of the material of a glass block. *(06 marks)*

7. (a) Distinguish between **primary** and **secondary** cells and give **one** example of each. *(03 marks)*

(b) State **two** precautions one has to undertake to prolong the life of a lead- acid accumulator. *(02 marks)*

(c) Define **potential difference** across a resistor in a circuit. *(01 mark)*

(d) With the aid of a circuit diagram, describe how you can determine internal resistance of a cell. *(05 marks)*

(e) Resistors of 4 Ω, 3 Ω and 2 Ω are connected as shown in figure **5** across a battery of e.m.f 2 V and negligible internal resistance.

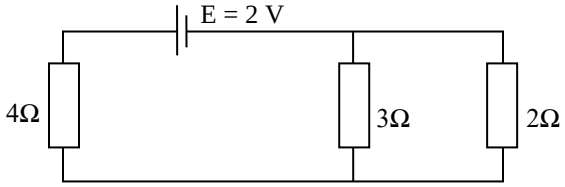

Figure **5**

Calculate the current through the 4 Ω resistor. *(05 marks)*

7. (a) Define **energy** and state its **SI unit**. *(02 marks)*

(b) Give **two** examples of primary sources of

(i) renewable energy. *(01 mark)*
(ii) non-renewable energy. *(01 mark)*

(c) Describe the energy changes that occur when a filament bulb is connected to a battery lights. *(04 marks)*

(d) (i) Describe the operation of a simple dynamo. *(05 marks)*
(ii) State three factors on which the e.m.f produced by a dynamo depends. *(03 marks)*

8. (a) List ant **two** differences between X-rays and gamma rays. *(02 marks)*

(b) With the aid of a labelled diagram describe how X-rays are produced. *(07 marks)*

(c) What are the differences between hard and soft X-rays? *(02 marks)*

(d) Define the following;

(i) radioactive nuclide. *(01 mark)*
(ii) isotopes. *(01 mark)*

(e) Outline **three** uses of radioactivity. *(03 marks)*

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2012
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Velocity of electromagnetic waves	=	3.0 x 10^{8} ms^{-1}

1. (a) (i) What is the difference between **vector** and **scalar** quantities? (*02 marks*)

(ii) Give **two** examples of each quantity in (a) (i) above. (*02 marks*)

(ii) Two forces of 7 N and 9 N act perpendicularly on a body of mass 2 kg. Find the acceleration of the body. (*04 marks*)

(b) Describe an experiment to determine the centre of gravity of irregular sheet of metal. (*04 marks*)

(c) A ball is whirled in air in a horizontal circle as shown in figure **1**.

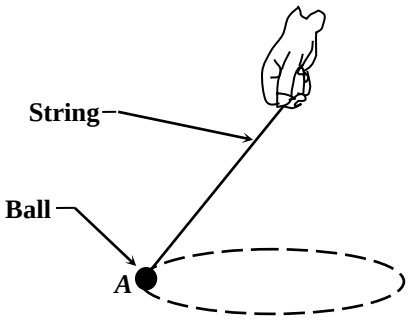


Figure **1**

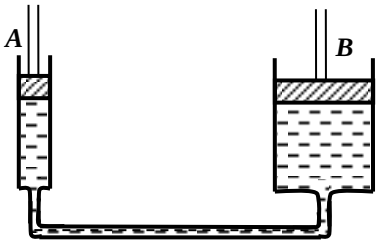
(i) Copy the diagram and show on it the forces acting on the ball in position *A*. (*01 mark*)

(ii) Explain what happens if the string breaks when the ball is in position *A*. (*03 marks*)

2. (a) (i) Define **pressure**. (*01 mark*)

(ii) Explain what happens when an inflated balloon is released in air. (*03 marks*)

(b) Figure **2** shows a hydraulic press. *A* and *B* are cylindrical pistons of radii 2 cm and 4 cm respectively.



Calculate the maximum force at *B* that can be overcome by a force of 78 N applied at *A*. (*03 marks*)

(c) Describe with the aid of a diagram, how a force pump works. (*05 marks*)

(d) (i) State the law of conservation of energy. (*01 mark*)

(ii) A stone of mass 0.2 kg is thrown vertically upwards attaining maximum potential energy of 16 J. Calculate its initial velocity. (*03 marks*)

3. (a) What is meant by **diffraction** of waves? (*01 mark*)

(b) Figure **3** shows plane wave fronts incident on a barrier with two slits.

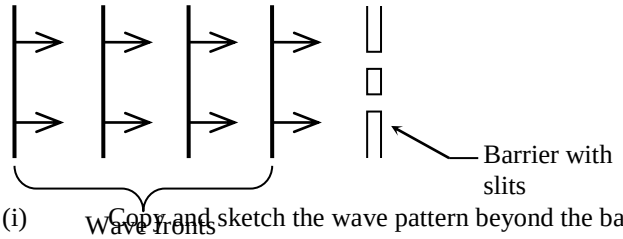


Figure **3**

(i) Copy and sketch the wave pattern beyond the barrier. (*02 marks*)

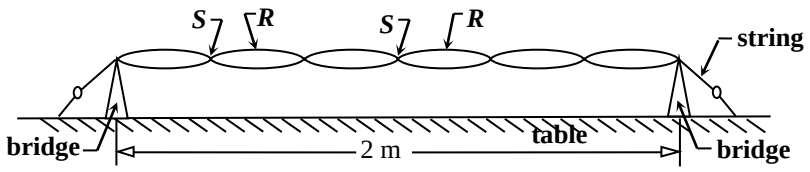
(ii) Describe what happens if the slits are narrowed. (*02 marks*)

(c) Explain why the speed of sound at the top of a higher mountain is different from that at sea-level. (*03 marks*)

(d) An experimenter standing between two high walls produces sound by hitting two pieces of wood. If the first echo is heard after 3.5 s and the second echo 2 s later, find the distance between the walls. *(Speed of light in air = 330 m s $^{-1}$)* (*04 marks*)

(e) What is meant by a **standing wave**? (*01 mark*)

(f) Figure **4** shows a string stretched between two bridges. When it is plucked at some point it vibrates as shown.



(i) Name the points marked *R* and *S*. (*01 mark*)

(ii) Calculate the wavelength of the wave in the string. (*02 marks*)

4. (a) (i) What is meant by **light**? (*01 mark*)

(ii) Describe an experiment to show that light travels in a straight line. (*04 marks*)

(b) Define the following;

(i) Power of a lens. (*01 mark*)

(ii) Aperture of a lens. (*01 mark*)

(c) Figure **5** shows light travelling from glass to air.

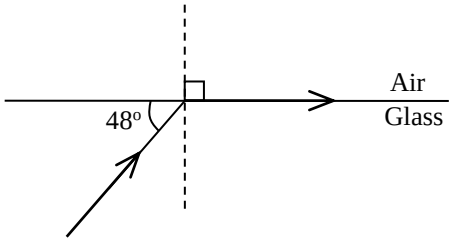


Figure **5**

Find the refractive index of the glass. (*03 marks*)

(d) An object 5 cm high is placed 30 cm away from a concave lens. Find graphically the size of the image that is formed 15 cm from the lens. (*02 marks*)

(e) Describe briefly how short sightedness can be corrected. (*04 marks*)

5. (a) Define **specific latent heat of vaporization** of a substance. (*01 mark*)

(b) (i) A calorimeter of mass 20 g and specific heat capacity 800 J kg $^{-1}$ K $^{-1}$ contains 500 g of water at 30^{O}C. Dry steam at 100^{O}C is passed through the water in the calorimeter until the temperature of water rises to 70^{O}C. If the specific latent heat of vaporization of water is 2260,000 J kg $^{-1}$, calculate the mass of the water condensed. (*04 marks*)

(ii) Water initially at 25^{O}C was heated. Sketch a graph to show how its temperature varied with time. (*01 mark*)

(c) Describe briefly one application of evaporation. (*02 marks*)

(d) (i) What is a **notch**? (*01 mark*)

(ii) State four ways by which damage due to notches may be prevented. (*04 marks*)

(e) Why is a bicycle frame made of hollow cylindrical pipes? (*03 marks*)

6. (a) (i) What are **ferromagnetic** materials? (*01 mark*)
(ii) Give **two** examples of ferromagnetic materials. (*02 marks*)

(b) (i) With the aid of a diagram, describe the application of an electromagnet in magnetic relays. (*06 marks*)
(ii) Give **one** advantage of using a magnetic relay to switch electrical machinery on and off. (*01 mark*)

(c) Figure **6** shows wires *AB* and *DE* placed parallel and close to each other carrying currents in opposite directions.

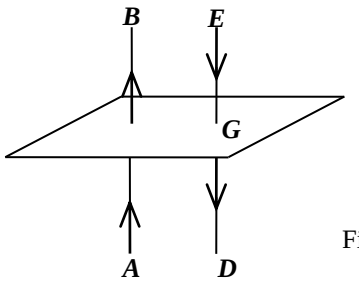


Figure **6**

(i) Copy the diagram and sketch the magnetic field pattern between the two wires. (*02 marks*)
(ii) Show the direction of the force acting on *DE* at *G* due to the current in *AB*. (*01 mark*)

(d) Describe briefly how one can test for polarity of a magnet. (*03 marks*)

7. (a) Define the following terms;

(i) Potential difference. (*01 mark*)
(ii) Internal resistance of a cell. (*01 mark*)

(b) A battery of emf 10 V is connected to resistors 2.6 Ω, 4 Ω and 6 Ω as shown in Figure **7**.

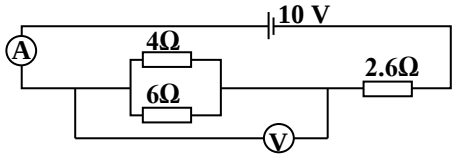


Figure **7**

(i) Calculate the ammeter and voltmeter readings. (*06 marks*)
(ii) Find the rate at which electrical energy is converted to heat energy in the 6 Ω resistor. (*03 marks*)

(c) What is meant by a short circuit? (*01 mark*)

(d) (i) Briefly explain how a milliammeter can be adopted to measure much higher currents. (*06 marks*)
(ii) State **two** ways of increasing the sensitivity of electrical meters. (*06 marks*)

8. (a) (i) Define the term **half-life** as applied to radioactivity. (*01 mark*)
(ii) A radioactive material has a half-life of 5 minutes. If the initial mass of the material is 120 g, calculate the mass that decays after 20 minutes. (*05 marks*)
(iii) Sketch a graph of the number of atoms of a radioactive material present against time to show how the half-life is determined from it. (*02 marks*)

(b) Explain the nature of the tracks of alpha particles and beta particles in air. (*06 marks*)

(c) How does a passage of a beta particle through an electric field differ from that of an X-ray? (*02 marks*)

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2013
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

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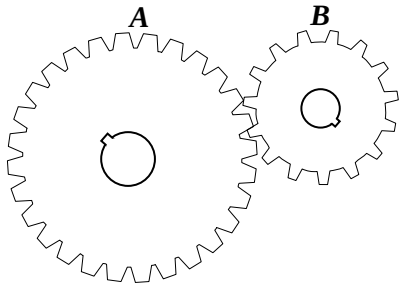
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	330 m s^{-1}
Density of water	=	1000 kg m^{-3}

1. (a) Define the term **velocity ratio** and **efficiency** as applied to machines. (*02 marks*)

(b) (i) Draw a diagram of a single string pulley with system velocity ratio 6. (*02 marks*)
(ii) Calculate the efficiency of the pulley system in (b) (i) above if an effort of 1,000 N is required to raise a load of 4,500 N. (*03 marks*)
(iii) Find the energy wasted when a load of 1,500 N is lifted through 2 m by the pulley system in (b) (i). (*04 marks*)

(c) Explain why the fulcrum must be nearer to the load than to the effort in a first class lever. (*02 marks*)

(d) Figure **1** shows gear wheels.



Explain how ***A*** and ***B*** should engage to give a turning effect force of low mechanical advantage. (*03 marks*)

2. (a) State the law of **Conservation of energy**. (*01 marks*)

(b) A pendulum bob of mass 200 g is pulled sideways through a vertical height of 40 cm. Calculate the maximum,

(i) potential energy gained (*02 marks*)
(ii) speed of the bob when the pendulum is released. (*02 marks*)

(c) State why a swinging pendulum eventually comes to rest after sometime. (*01 mark*)

(d) Explain why a steel ball falling through oil in a tall jar first accelerates and then after accelerations decreases to zero. (*03 marks*)

(e) (i) Define the terms **distance** and **displacement**. (*02 marks*)
(ii) Sketch a velocity time graph for a body experiencing a net force of zero. (*01 mark*)

(f) A uniform metre rule is balanced horizontally on a pivot at the 15 cm mark when a load of 7 N is attached at zero mark as shown in figure **2**.

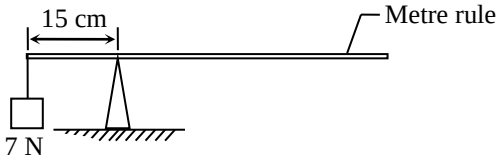


Figure **2**

Find the weight of the metre rule. (*03 marks*)

3. (a) What is **saturated vapour**? (*01 mark*)

(b) Explain why water boiling in a container stops boiling momentarily when the lid of the container is removed. (*03 marks*)

(c) A metal block of 3 kg at $100^{o}C$ is placed in 2.5 kg of water at $31^{o}C$ in a copper calorimeter of 0.4 kg. The water is then stirred until it attains a steady temperature of $43^{o}C$. Calculate the specific heat capacity of the metal block. (*04 marks*)

(d) (i) List the possible sources of errors in the experiment like the one in (c) above. (*02 marks*)

(ii) Suggest how each of the errors you have listed in (d) (i) can be minimized. (*02 marks*)

(e) The set up in figure **3** is used to demonstrate convection in air.

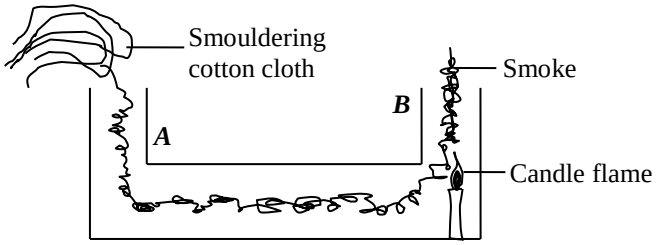


Figure **3**

Explain why smoke from the smouldering cotton cloth seen to enter through cylinder ***A*** and come out through ***B***. (*04 marks*)

4. (a) State the **laws of reflection**. (*02 marks*)

(b) (i) With the aid of a diagram, describe how a pin hole camera works. (*03 marks*)

(ii) State the nature of the image formed by a pin hole camera. (*02 marks*)

(c) With the aid of a diagram, describe how total eclipse and partial eclipse of the moon occur. (*06 marks*)

(d) Explain how a curved mirror can be used as a solar collector. (*03 marks*)

5. (a) (i) What is meant by **sound**? (*01 mark*)

(ii) State two factors that affect the motion of sound waves. (*02 marks*)

(b) Figure **4** represents a wave motion in which a crest moves from ***O*** to ***P*** in 8 seconds.

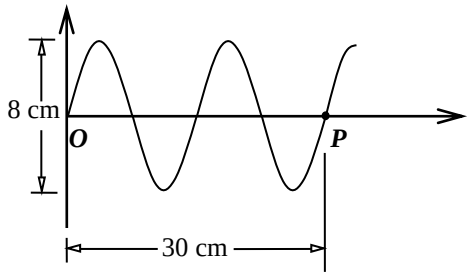


Figure **4**

Find

(i) amplitude. (*01 mark*)

(ii) wavelength. (*01 mark*)

(iii) frequency. (*03 marks*)

(c) Plane waves move towards a reflector as shown in figure **5**.

Figure **5**

Copy and complete the diagram to show the motion of the waves after reflection. (*02 marks*)

(d) State the effect of constructive interference of

(i) sound waves (*01 mark*)
(ii) light waves. (*01 mark*)

(e) Describe an experiment to demonstrate resonance in a closed pipe (*04 marks*)

6. (a) (i) What is a **magnetic field**? (*01 mark*)
(ii) Sketch the magnetic field pattern between two bar magnets placed on a horizontal surface with their south poles facing each other. (*04 marks*)

(b) (i) Explain why the strength of a magnet can not be increased beyond a certain limit. (*02 marks*)
(ii) With the aid of a suitable diagram, show how a U-shaped piece of steel can be magnetized by electrical method. (*04 marks*)

(c) A bare copper wire AB lie horizontally over fixed rails X and Y connected to a battery as shown in figure **6**. The rails X and Y are placed between the poles of a U-shaped magnet.

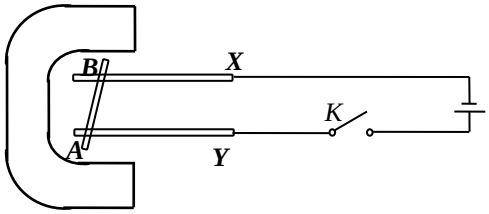


Figure **6**

Explain what happens to ***AB***,

(i) when switch *K* is closed. (*02 marks*)
(ii) if two cells are used instead of one cell. (*02 marks*)

(d) Name **two** instruments which use the effect in (c). (*02 marks*)

(e) State **two** ways of demagnetizing a magnet. (*01 mark*)

7. (a) (i) Define **electrical resistance**. (*01 mark*)
(ii) State **three** physical properties that affect resistance of a metal wire. (*03 marks*)

(b) Draw a sketch graphs of current against p.d for the following;

(i) a metal wire. (*01 mark*)
(ii) a semi-conductor diode. (*01 mark*)

(c) A battery of e.m.f 3.0 V and negligible internal resistance is connected across three resistors of 5 Ω, 2 Ω and 2 Ω as shown in figure **7**.

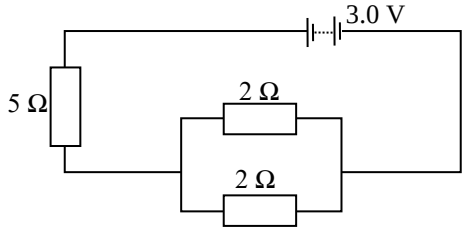


Figure **7**

Calculate the:

(i) current supplied by the battery. (*04 marks*)
(ii) power dissipated in the 5 Ω resistor. (*03 marks*)

(d) Explain why a wire heats up when current is passed through it. (*03 marks*)

8. (a) What are **cathode rays**? (*01 mark*)

(b) (i) Draw a labelled diagram to show the main features of a cathode ray tube. (*02 marks*)

(ii) Describe briefly how cathode rays are produced in the cathode ray tube. (*02 marks*)

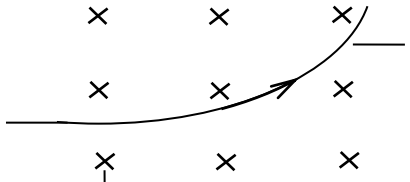
(iii) State **two** uses of a cathode ray oscilloscope. (*01 marks*)

(c) Define the following terms as applied to radioactivity:

(i) **Isotope**, (*01 mark*)

(ii) **Half-life**. (*01 mark*)

(d) The diagram in figure **8** shows the path of particle P, emitted from a radioactive sample of rock, passing through a region of a uniform magnetic field directed perpendicular into paper.



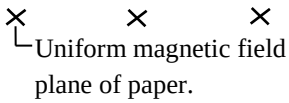


Figure **8**

(i) Identify the particle *P*. (*01 mark*)

(ii) Describe the changes that take place in the nuclear structure of an element ***X*** with atomic number 88 and mass number 226 when it emits particle *P*, identified in (d) (i). (*02 marks*)

(e) (i) The mass of a radioactive substance decays to $\frac{1}{16}$ of its original value after 36 days.

Find its half-life. (*03 marks*)

(ii) State **one** medical use and **one** non-medical use of radioactive tracers. (*02 marks*)

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PHYSICS
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UGANDA NATIONAL EXAMINATIONS BOARD

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Specific latent heat of fusion of water	=	340000 J kg^{-1}
Speed of sound in air	=	320 m s^{-1}
Velocity of electromagnetic waves	=	3.0 x 10^{8} ms^{-1}

1. (a) (i) Define **moment** of a force. (*01 mark*)

(ii) Describe a simple experiment to verify the principle of moments. (*05 marks*)

(iii) A uniform metre rule is pivoted at the 20 cm mark as shown in Figure **1**.

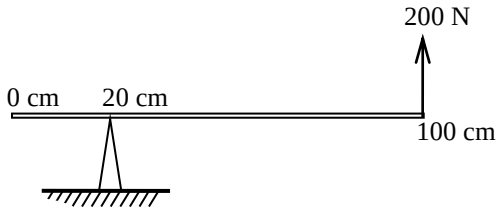

Figure **1**

When a force of 200 N acts on it at 100 cm mark, the metre rule remains in the horizontal position. Find the weight of the metre rule. (*03 marks*)

(b) State Archimedes principle. (*01 mark*)

(c) A test tube is partly filled with lead shots and made to float in water as shown in figure **2**.

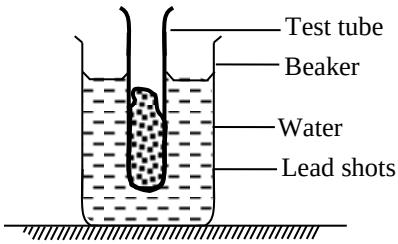

Figure **2**

The length of the tube submerged and the level of the water are noted. State what happens to the length of the tube submerged and the level of the water in the beaker when

(i) some lead shots are removed from the beaker. (*02 marks*)

(ii) the temperature of the water is increased. (*02 marks*)

(d) Explain your observation in (c) (i). (*02 marks*)

2. (a) (i) What is **force**? (*01 mark*)

(ii) State the unit of force. (*01 mark*)

(b) A block of wood is placed on a rough table and horizontally using a string attached to it. Draw a labelled sketch diagram showing the forces acting on the block. (*02 marks*)

(c) Describe an experiment to demonstrate surface tension in a liquid. (*03 marks*)

(d) A parachutist falling with a constant vertical velocity of 16 ms $^{-1}$ is being blown by wind moving horizontally at 12 ms $^{-1}$.

(i) Find the resultant velocity of the parachutist. (*04 marks*)

(ii) If the parachutists jumps from a height of 500 m, directly above the target, find the horizontal velocity by which the parachutist will miss the target. (*02 marks*)

(e) Explain why a ship made of iron and steel floats on water. (*03 marks*)

3. (a) (i) What is a **virtual image**? (*01 mark*)

(ii) Under what condition is a virtual image formed by a concave mirror? (*01 mark*)

(b) Describe how the focal length of a concave mirror can be determined. (*04 marks*)

(c) An object 2.0 cm tall is placed 8 cm in front of a convex lens of focal length 12 cm. Construct ray diagram to determine the;

(i) position of the image. (*03 marks*)
(ii) magnification produced. (*02 marks*)

(d) (i) What is meant by **refractive index** of a material? (*01 mark*)
(ii) Explain how dispersion of white light takes place in a glass prism. (*04 marks*)

4. (a) Define the **Hertz** as applied to waves. (*01 mark*)

(b) (i) Explain what is meant by **resonance**. (*02 marks*)
(ii) Describe an experiment to measure the speed of sound in air using a resonance tube. (*05 marks*)

(c) Figure **3** shows a point vibrator, *V*, of frequency 30 Hz used to produce water ripples of speed 60 ms $^{-1}$ in a ripple tank *PQRS*. If *AB* and *CD* are straight and convex barriers respectively.

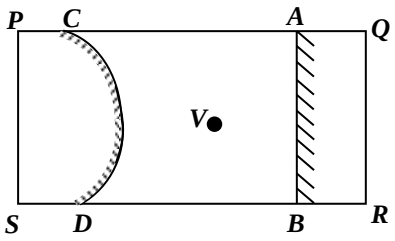

Figure **3**

(i) sketch waves forms showing the incident and reflected wave forms at the barriers. (*03 marks*)
(ii) find the distance between two successive crests of the waves produced by the vibrator. (*03 marks*)

(d) (i) What is an **echo**? (*01 mark*)
(ii) State **one** practical use of echoes. (*01 mark*)

5. (a) Define specific **latent heat of vaporization**. (*01 mark*)

(b) Describe how to determine specific latent heat of vaporization of steam. (*06 marks*)

(c) A copper calorimeter weighs 0.1 kg when empty and 0.3 kg when filled with water at $40^{o}C$. A mass of 0.005 kg of steam is passed into the calorimeter until a final steady temperature is reached. Neglecting heat loses to the surroundings; calculate the final temperature of the calorimeter and its contents. (*04 marks*)

(*Specific latent heat of vaporization of steam* $= 2.26 \times 10^{6} J\ kg^{-1}$ *; specific heat capacity of copper* $= 400 J\ kg^{-1}K^{-1}$).

(d) (i) What is **saturated vapour**? (*01 mark*)
(ii) Use kinetic theory of matter to explain how evaporation causes cooling. (*04 marks*)

6. (a) What is a **Volt**? (*01 mark*)

(b) A lamp is marked 240 V, 60 W. Explain what this means. (*02 marks*)

(c) (i) Use a diagram to show how three identical cells, each of e.m.f 1.5 V and internal resistance 0.1 Ω, can be arranged to give minimum e.m.f. (*02 marks*)
(ii) Calculate the current flowing in the circuit of the arrangement in (c) (i), if tow resistors of resistances 4 Ω and 5 Ω are included in series in the circuit. (*06 marks*)

(d) (i) State **two** sources of e.m.f. (*01 mark*)
(ii) With the aid of a labelled diagram, describe how an accumulator can be charged fully. (*04 marks*)

7. (a) What is meant by

(i) magnetic saturation. (*01 mark*)
(ii) magnetic screening. (*01 mark*)

(b) (i) Describe the domain theory of magnetism. (*03 marks*)
(ii) Use the above theory to explain demagnetization. (*02 marks*)

(c) Draw magnetic field lines due to

(i) a bar magnet placed horizontally with its axis in the magnetic meridian and its north pole pointing south. (*02 marks*)
(ii) a bar of unmagnetised iron placed along the axis of the earth field. (*02 marks*)

(d) (i) State how a galvanometer can be used to measure large currents. (*01mark*)

(ii) A galvanometer gives a full scale deflection for a current of 0.1 A, and its resistance is 0.5 Ω. Determine the value of resistance necessary to convert it into a voltmeter which reads up to 100 V. (*04 marks*)

8. (a) (i) What are **cathode rays**? (*01 mark*)
(ii) Describe how cathode rays are produced in a cathode ray tube. (*04 marks*)

(b) With reference to an X-ray tube, explain

(i) why the tube is evacuated. (*03 marks*)
(ii) why the tungsten target is embedded in copper block. (*02 marks*)
(iii) how the penetrating power of X-rays can be varied. (*03 marks*)

(c) (i) What is **radioactivity**? (*01 mark*)
(ii) Describe **one** use of radioactivity. (*02 marks*)

END

535/2
PHYSICS
Paper 2
Oct. / Nov.2015
2 1/4 hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer any **five** *questions.*

Any additional question(s) answered will **not** *be marked.*

Mathematical tables and silent non programmable calculators may be used.

These values of physical quantities may be useful to you.

Acceleration due gravity, g	=	10 m s^{-2}
Specific heat capacity of water	=	4200 J kg^{-1} K^{-1}
Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Specific latent heat of vaporization of water	=	2,260,000 J kg^{-1}
Density of water	=	1,000 kgm^{-3}

1. (a) (i) State **Pascal's** principle. (*01 mark*)

(ii) Give **three** instances where Pascal's principle is applied. (*03 marks*)

(iii) Describe an experiment to show that pressure in a liquid increases with depth. (*03 marks*)

(iv) Describe how a manometer is used to measure gas pressure. (*03 marks*)

(b) Two microscope slides are pressed together with water film in between them as shown in figure **1**.

Figure **1**

Explain why it is very difficult to pull the slides apart. (*02 marks*)

(c) A barometer reads 76 cm Hg and 73.8 cm Hg at the bottom and top of a mountain respectively. If the density of air is 1.25 kg m $^{-3}$ and that of mercury is 13,600 kg m $^{-3}$, find the height of the mountain. (*04 marks*)

2. (a) A block of plastic and a block of lead, each 0.2 kg are released simultaneously to fall down a well with water at the bottom. The lead block took 4.0 s to reach the water surface.

(i) State and explain any difference in the time of arrival of the two blocks at the surface of water. (*03 marks*)

(ii) Calculate the speed with which the lead block strikes the water surface. (*02 marks*)

(iii) Find the distance of the water surface from the top of the well. (*02 marks*)

(b) Figure **2** represents the velocity – time graph for a ball which is projected up a smooth inclined plane.

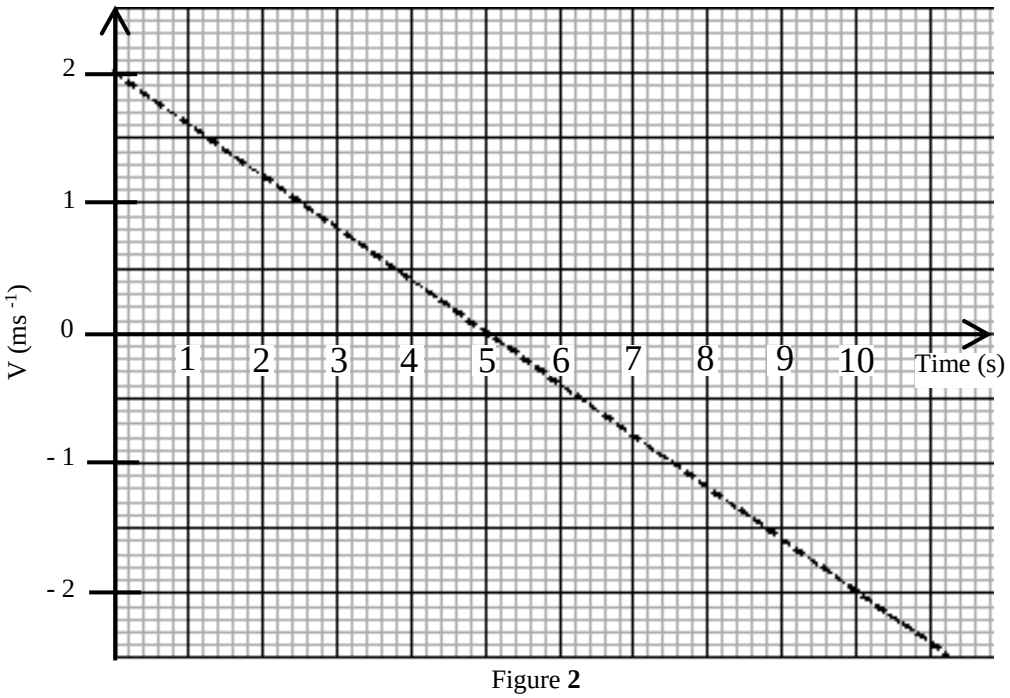

Figure **2**

(i) How far does the ball move in the first 5 s? (*02 marks*)

(ii) What is the velocity of the ball after 8 s? (*01 mark*)

(c) Describe an experiment to measure acceleration of a body using a ticker-timer of frequency 50 Hz. (*06 marks*)

3. (a) Define **specific latent heat of vaporization**. (*01 mark*)

(b) (i) Describe an experiment to determine the specific latent heat of vaporization of water. (*04 marks*)

(ii) A pan contains 4.0 kg of water at $0^{o}C$. A jet of steam at $100^{o}C$ is passed through the water. What is the temperature of the water when 0.2 kg of steam have condensed in it? Assume that no heat is lost or absorbed by the pan. (*06 marks*)

(c) (i) Differentiate between **evaporation** and **boiling**. (*02 marks*)
(ii) Explain in terms of the kinetic theory why evaporation produces cooling. (*03 marks*)
(iii) State **two** ways of making a liquid to evaporate more rapidly. (*01 mark*)

4. (a) What is meant by **dispersion** as applied to light? (*01 mark*)

(b) (i) State **two** advantages of a prism over a plane mirror in reflection of light. (*02 marks*)
(ii) With the aid of a diagram, describe the structure and working of a prism periscope. (*03 marks*)

(c) Explain the following;

(i) The colour of cyan filter when red light is passed through it. (*02 marks*)
(ii) The colour of magenta surface under yellow light. (*03 marks*)

(d) An object 4 cm tall is placed 4 cm in front of a concave mirror of focal length 12 cm. By graphical construction, find the position and nature of the image formed. (*05 marks*)

5. (a) Define the following as applied to wave motion:

(i) Frequency. (*01 mark*)
(ii) Amplitude. (*01 mark*)

(b) (i) Differentiate between **music** and **noise**. (*02 marks*)
(ii) Explain the factors which determine the pitch and quality of a note produced by a tuning fork. (*02 marks*)
(iii) Explain why reverberation in a concert hall is both desirable and undesirable. (*04 marks*)

(c) Describe an experiment to show that a material medium is necessary for transmission of sound. (*04 marks*)

(d) When a student standing 100 m away from the foot of a high wall claps, an echo is heard after 0.6 s. Calculate the velocity of sound in air. (*02 marks*)

6. (a) Differentiate between **electromotive force** and **potential difference**. (*02 marks*)

(b) Give **two** advantages of connecting bulbs in parallel to a battery. (*02 marks*)

(c) (i) State **ohm's law**. (*01 mark*)
(ii) Describe an experiment to verify ohm's law. (*06 marks*)

(d) Given the circuit in figure **3**.

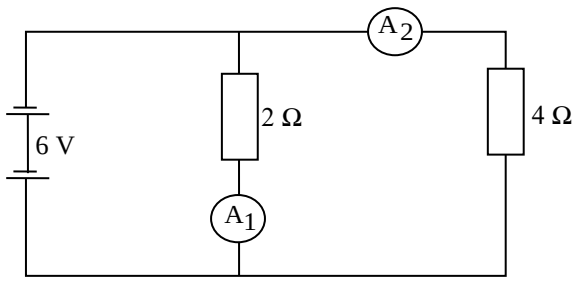

Figure **3**

Find the

(i) readings of ammeters A_1 and A_2. (*02 marks*)

(ii) total power dissipated in the resistors. (*03 marks*)

7. (a) A bar is placed with its axis along the magnetic meridian with its south pole pointing north.

(i) Sketch the magnetic flux pattern near the magnet in the earth's field. (*02 marks*)

(ii) With reference to the sketch, explain what is meant by a **neutral point** in a magnetic field. (*01 marks*)

(b) (i) Describe an experiment to determine the magnetic field pattern of a bar magnet using iron fillings. (*04 marks*)

(ii) State one advantage and one disadvantage of the method in (b) (i). (*02 marks*)

(c) Describe how the earth's magnetic meridian may be determined. (*03 marks*)

(d) A galvanometer has a coil of resistance 8 Ω and gives a full-scale deflection when a current of 0.5 mA is supplied. Calculate the resistance that can be used to convert it into an ammeter measuring up to 5 A. (*04 marks*)

8. (a) (i) What are **cathode rays**? (*01 mark*)

(ii) Give **two** properties of cathode rays. (*02 marks*)

(iii) State two differences between cathode rays and gamma rays. (*02 marks*)

(b) In the cathode ray oscilloscope, explain the effect of the following on the brightness of the electron spot on the screen.

(i) Increasing the filament current. (*02 marks*)

(ii) Decreasing the anode voltage. (*02 marks*)

(c) Figure **4** shows the appearance of the screen of the cathode ray oscilloscope when an a.c. voltage is connected across the Y-plate. A vertical trace of length 4 cm is formed. If the Y-gain is set at 5 V cm $^{-1}$, find the peak voltage of the a.c. voltage. (*03 marks*)

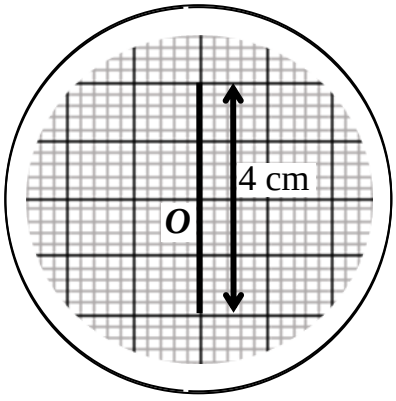

Figure **4**

(d) (i) What is meant by **nuclear fission**? (*01 mark*)

(ii) Outline the process involved in the generation of electricity using Uranium – 235. (*03 marks*)

535/2
PHYSICS
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UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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Specific heat capacity of copper	=	400 J kg^{-1} K^{-1}
Specific latent heat of fusion of water	=	340000 J kg^{-1}
Specific latent heat of vaporization of water	=	320 ms^{-1}
Velocity of electromagnetic waves	=	3.0×10^{8} ms^{-1}

1. (a) What is a **ductile** material? (*01 mark*)

(b) (i) State **Hooke's law**. (*01 mark*)
(ii) Describe an experiment to verify Hooke's law using a spring. (*05 marks*)
(iii) Give one application of Hooke's law. (*01 mark*)

(c) A force of 200 N stretches a metal wire of cross-sectional are 0.001 m^2 and length 5 m by 0.004 m. Calculate the
(i) strain produced. (*03 marks*)
(ii) stress on the wire. (*03 marks*)

(d) Why is a bridge constructed with one end resting on rollers? (*02 marks*)

2. (a) Define the following terms as applied to concave mirrors.

(i) Centre of curvature. (*01 mark*)
(ii) Principal axis. (*01 mark*)

(b) An object is placed 36 cm in front of a concave mirror of radius of curvature 24 cm.

(i) Draw a scale ray diagram to show the formation. (*03 marks*)
(ii) Find the magnification. (*02 marks*)

(c) (i) Explain why a small object at the bottom of a trough of water appears to be closer to the surface than it actually is. (*03 marks*)
(ii) Describe an experiment to determine the refractive index of a glass block. (*06 marks*)

3. (a) Define the following;

(i) Pressure. (*01 mark*)
(ii) Force. (*01 mark*)

(b) Describe a simple experiment to show that air in the atmosphere exerts pressure. (*05 marks*)

(c) A simple barometer is raised from sea level to a height of 2.5 km. Given that the average air density is 1.25 kg m^{-3}, find the new length of the mercury column in the barometer. (*04 marks*)

(d) (i) State any **three** applications of atmospheric pressure. (*03 marks*)
(ii) Why is a liquid used as he fluid in hydraulic machines instead of a gas? (*02 marks*)

4. (a) With the aid of a diagram, describe an experiment to measure resistance of a cell. (*04 marks*)

(b) (i) Define a **joule**. (*01 mark*)
(ii) Explain what is experienced by a person sitting near a large coil carrying electric current. (*03 marks*)

(c) Derive an expression for effective resistance, $\boldsymbol{R}$, of two resistors $\boldsymbol{R}_1$ and $\boldsymbol{R}_2$ connected in parallel. (*05 marks*)

(d) A battery of negligible internal resistance is connected across resistors of 3 Ω and 2 Ω as shown in figure **1**.

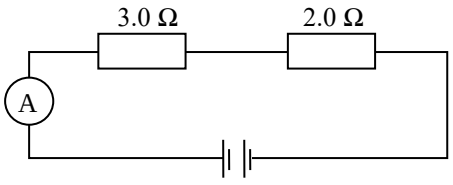

Figure **1**

Find the reading of the ammeter. (*03 marks*)

5. (a) What is meant by **sound waves**? (*01 mark*)

(b) Describe with the aid of a labelled diagram how a sound wave is transmitted from a ringing bell to the ear. (*05 marks*)

(c) Name three **types** of electromagnetic waves and state their uses. (*03 marks*)

(d) Find the wavelength of radio waves of frequency 1.0×10^{8} Hz. (*03 marks*)

(e) Describe how communication between the earth and the moon is possible in spite of there being no atmosphere around the moon. (*03 marks*)

6. (a) Figure **2** shows a velocity-time graph for a body.

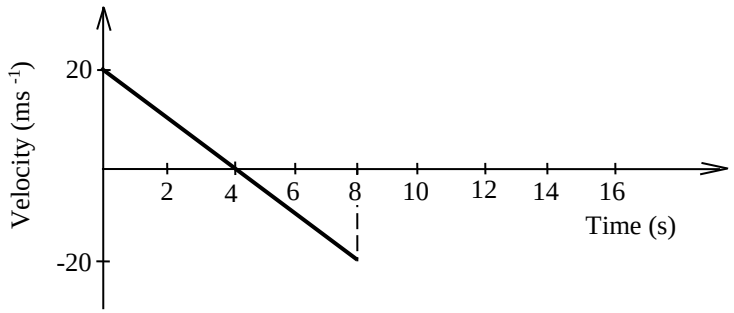

Figure **2**

(i) Describe the motion of the body. (*03 marks*)

(ii) Calculate the total distance covered by the body in 8 s. (*03 marks*)

(b) (i) State Newton's second law of motion. (*01 mark*)

(ii) A constant force of 0.25 N is applied on a body of mass 125 g. If the body accelerates uniformly, find its acceleration. (*03 marks*)

(c) Describe briefly, how acceleration due to gravity can be determined using a small mass, a piece of thread, a stop clock, a meter rule, a clamp and a stand. (*06 marks*)

7. (a) What are X-rays? (*01 mark*)

(b) (i) With the aid of a labelled diagram, describe how X-rays are produced in an X-ray tube. (*05 marks*)

(ii) State **one** medical use and **one** industrial use of X-rays. (*02 marks*)

(c) Define the following :

(i) Nuclear fission. (*01 mark*)

(ii) Nuclear fusion. (*01 mark*)

(d) A radioactive nuclide ${}^{235}_{92}\mathrm{A}$ decays by emission of two alpha particles. The resulting nuclide emits three beta particles resulting into a nuclide which emits gamma rays. Determine the atomic mass and the number of protons of *Y* and write a balanced equation for the decay. (*03 marks*)

(e) (i) What is meant by **half-life** of a radioactive substance. (*01 mark*)

(ii) The half-life of Radium is 1620 years. How long will it take 16 g of Radium to decay to 2 g? (*02 marks*)

8. (a) (i) Draw a labelled diagram showing the essential features of the moving-coil galvanometer. (*03 marks*)

(ii) Explain why the coil of the galvanometer rotates about its axis when a current passes through it, and why it settles in a definite position for a given value of current. (*03 marks*)

(iii) State four factors on which the deflection of the coil of the instrument depends. (*02 marks*)

(b) Explain how energy losses in an a.c transformer are minimised. (*03 marks*)

(c) An a.c transformer has 200 turns on the primary coil. If 240 V is to be stepped up to 720 V, calculate the number of turns on the secondary coil. (*03 marks*)

(d) Explain why thick electric cables are used for power transmission. (*02 marks*)

END