FORM THREE PHYSICS TOPICAL QUESTION

NAME	
ADMISSION NUMBER	

CURRENT ELECTRICITY QUESTIONS

1. A current of 0.7A flows through a wire when a potential difference of 0.35V is applied at the ends of the wire. If the wire is 0.5m long and has a cross-sectional area of 8.0 x 103mm2, determine its resistivity. (3 marks)

2. (a) Define electric resistance. (1mark)

(b) Figure 11 shows three resistors as shown.

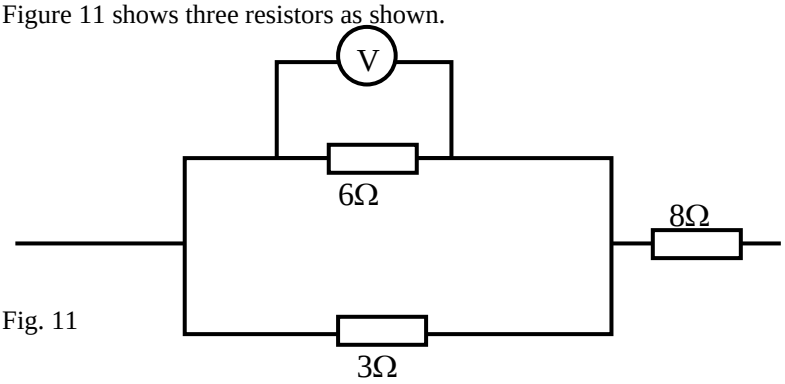


Fig. 11

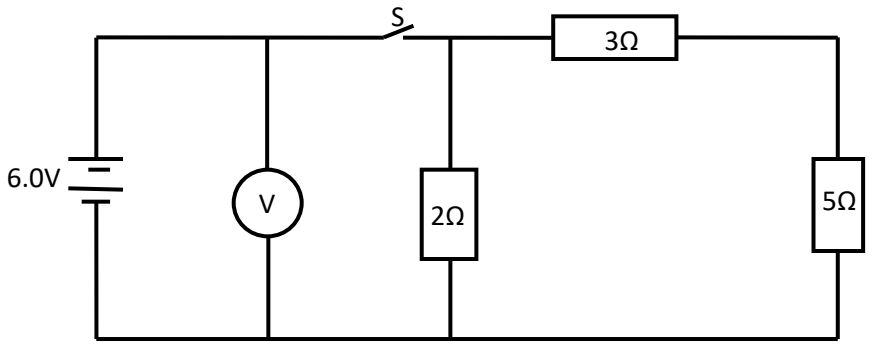
If the voltmeter reads 4V, find the

(i) Effective resistance (2 marks)
(ii) Current through the 3Ω resistor (2 marks)
(iii) Potential difference across the 8Ω resistor. (2 marks)

(c) (i) What is meant by the term "lost volts"? (1 mark)
(ii) A cell supplies a current of 0.5A when connected to a 2Ω resistor and 0.25A when connected to a 5Ω resistor. Find the e.m.f and the internal resistance of the cell. (4 marks)

3. (a) Differentiate between an Ohmic and non-ohmic conductor giving **one** example in each case.(2marks)
(b) **Figure 7** shows a circuit with resistors and voltmeter connected to a battery.

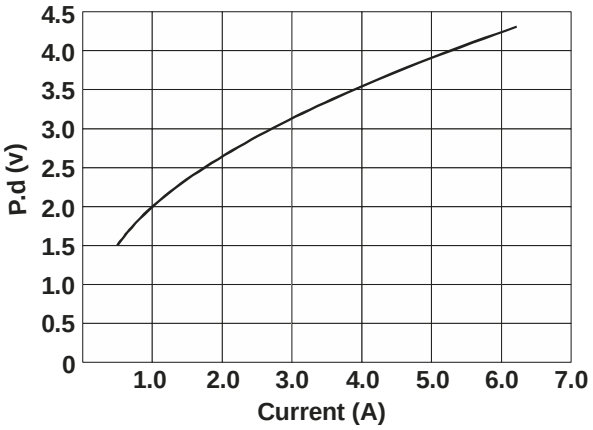
Figure 7



(i) If each cell has an internal resistance of 0.7Ω, determine the total resistance in the circuit. (3marks)
(ii) What amount of current flows through the 3Ω resistor when the switch is closed? (3marks)
(iii) What is the reading of the voltmeter when the switch S is
(I) Open (1mark)
(II) Closed (1mark)
(iv) Account for the difference between the answers in (I) and (II) above. (1mark)

4. A wire of resistance 20Ω is connected to a battery of 12V. Determine the heat dissipated in the wire in one minute. (3 marks)

5. (a) The following graph shows the potential difference, V against current, I for a certain device.



(i) State with a reason whether the device obeys Ohm's law. (1 mark)
(ii) Determine the resistance of the device when current is 1.0A. (1 mark)
(iii) State how resistance of the device varies as current increases from zero to 5.0A. (1 mark)

(b) When the switch S is kept open in the circuit shown in **figure 12** the voltmeter reads 1.5V. When the switch is closed, the readings drops to 1.3V and the current through the resistor is 0.5A.

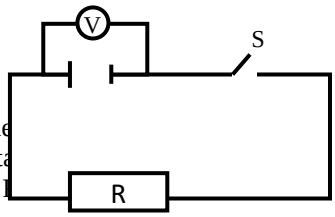


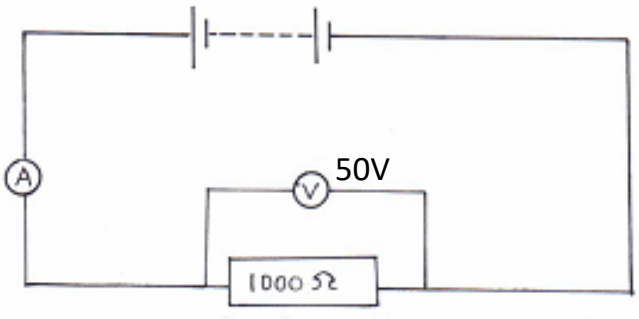
Fig 12

(i) What is the e.m.f of the (1 mark)
(ii) What the terminal volta (1 mark)
(iii) Calculate the value of (2 marks)

6. A wire of resistance 27 ohms is cut into three equal lengths. If the three wires are connected in parallel, what is the effective resistance? (2 marks)

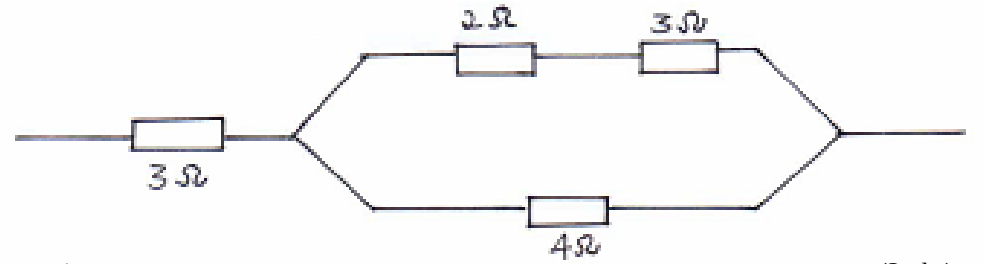
7. A heater of resistance R_1 is rated P watts, V volts while another of resistance R_2 is rated 2P watts, $^{V}/_{2}$ volts. Determine the ratio R_1 to R_2. (3mks)

8. (a) State ohms law. (1mk)
(b) Figure 8 below shows a large battery connected a resistor of 1000Ω. The potential difference across the resistor is 50V.



Determine:

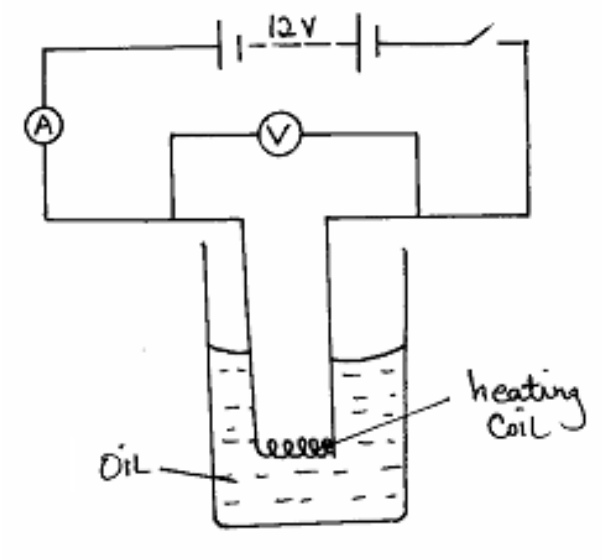
(i) The ammeter reading (A). (3mks)
(ii) The electrical energy dissipated by the resistor in one minute. (3mks)
(c) Figure 9 below shows some resistors connected in part of a circuit.



Determine the effective resistance. (3mks)
(d) Four 40w bulbs and six 100w bulbs were switched on for 2 hours in the morning and 3 hours at night each day for domestic use in a certain institution. Find the monthly bill for the consumer given that the cost of electricity in the country is at Sh.6.50 per unit. (Take one month to be of 30 days). (3mks)

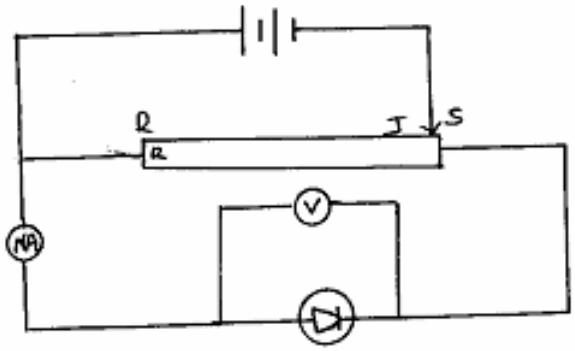
9. The figure 4 shows a circuit with a coil used to warm oil in a beaker.

Figure 4



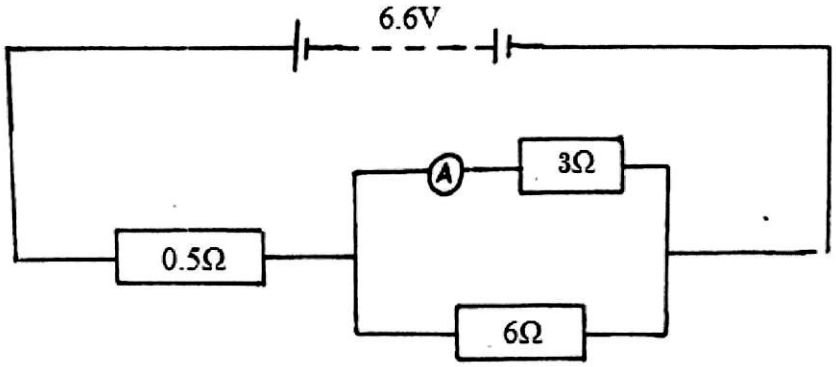
(a) State the Ohm's Law. (1mk)
(b) (i) Explain how heat is produced in the coil. (2mks)
(ii) Given that the reading of the ammeter is 2.5A, determine the resistance of the coil. (3mks)
(iii) How much heat is produced in the coil in a minute? (3mks)
(iv) Give **two** changes that can be made in the set-up in order to produce more heat per minute. (2mks)
(c) Figure 5 below shows a circuit used to study behaviour of diode.

Figure 5



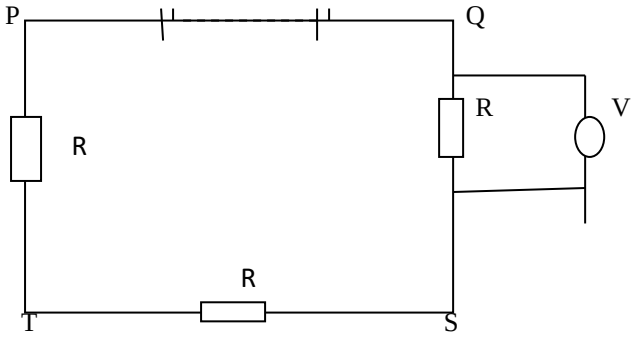
State the behaviour of voltmeter reading as Jockey J is moved from **S** to **R**. Explain. (2mks)

10. In the circuit shown below, the battery has an e.m.f. of 6.6V and internal resistance of 0.3Ω.



Determine the reading of the ammeter. (3mks)

11. (a) The circuit diagram in the figure below shows three identical resistors connected to a cell of e.m.f 12V



(i) Determine the reading of the voltmeter. (2 Mks)

(ii) If another identical resistor R is connected parallel to PT, determine the potential difference across Qs.(3 Mks)

(b) Explain why the earth pin in the mains plug is longer than the neutral and live pins. (1 Mk)

(c) Give one example of a semi conductor and one example of a conductor. (2 Mks)

(d) A hair dryer rated 1000W, 240V runs for 3 hours per day for 7 days. Calculate;

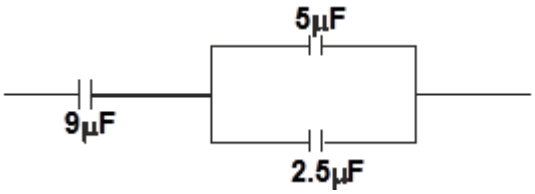
(i)The number of KWh used. (2 Mks)

(ii)The cost of electricity paid at the rate of Ksh 5.50 per unit. (2 Mks)

NAME	
ADMISSION NUMBER	

ELECTROSTATICS II QUESTIONS

1. The figure below shows part of an electric circuit. The charge stored in the 9 F capacitor is 1.4 micro coulombs (C)



Determine the p.d across the 5 F capacitor. (3 (marks)

2. a) The distance of separation between the plates of a certain capacitor is reduced. State how this affects the capacitance of a capacitor. (1 mark)

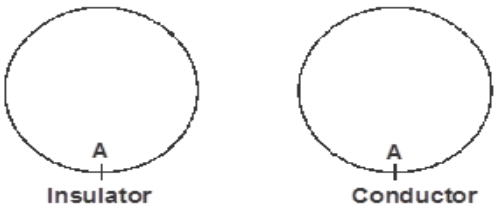
b) You are provided with the following apparatus used for studying charging of a capacitor.

An uncharged capacitor, voltmeter, milliameter, 6V battery, connecting wires, a switch and a load resistor R.

i) Draw a circuit diagram that can be used to charge the capacitor. (2 marks)
ii) Use the circuit diagram drawn above to explain how the capacitor gets charged. (3 marks)

iii) State the purpose of resistor R. (1 mark)

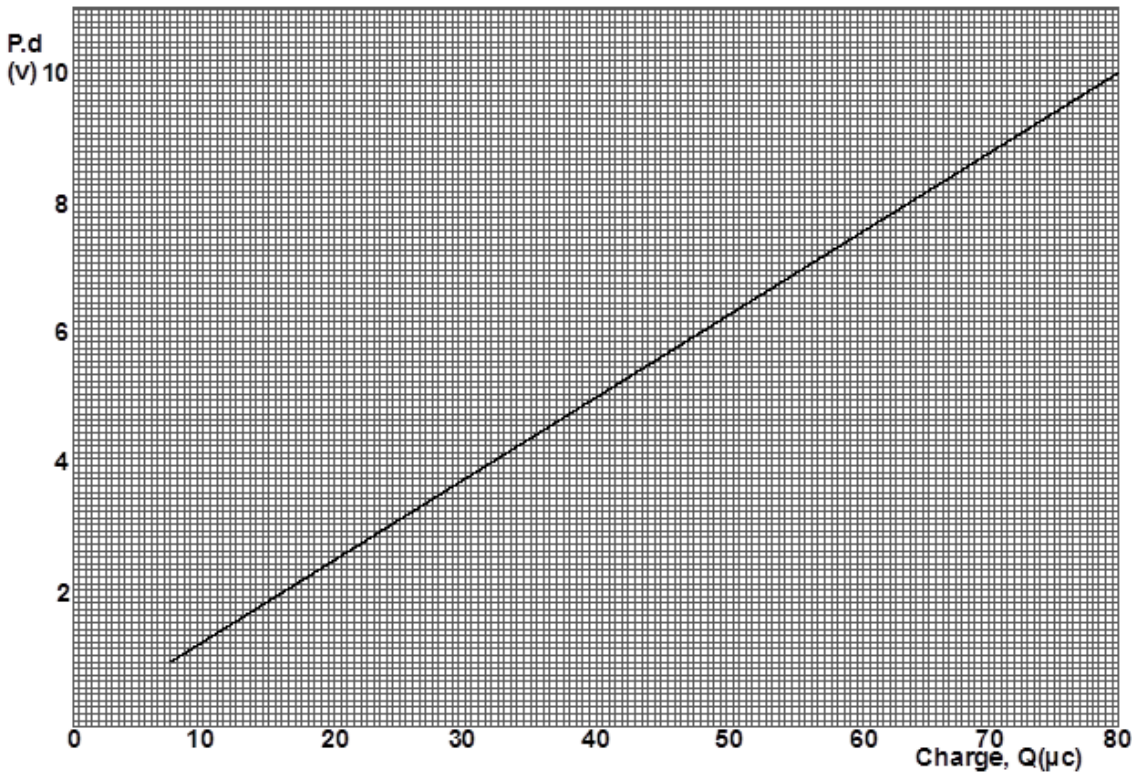
3. The figure below shows two spherical materials, one an insulation conductor and the other a conductor. Negative charges are introduced at point A in each case.



On the same figure indicate the final position of the charges. Explain your answer. (2 marks)

4. Figure 5 shows a relationship between potential difference V and the charge Q across and stored in a capacitor.

Fig 5



Determine the capacitance C of the capacitor. (3 marks)

5. Figure 10, shows a circuit that may be used to charge a capacitor.

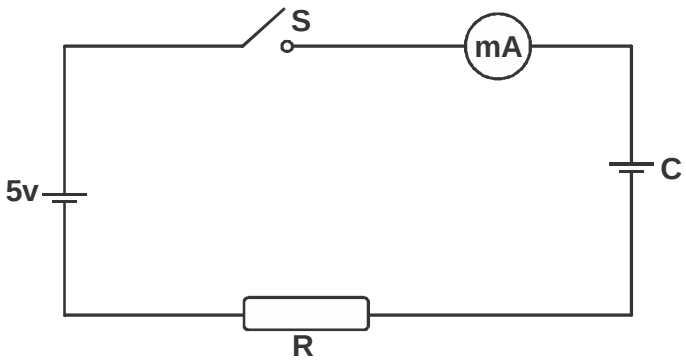


Figure 10

i) State the observation on the milliameter when the circuit is switched on. (1 mark)

ii) Explain the observation (i) above. (2 marks)

b) The circuit in figure 10 is left on for some time. State the value of p.d across;

i) The resistor R. (1 mark)

ii) The capacitor C (1 mark)

c) Sketch the graph of potential difference (V) across R against time. (1 mark)

d) Figure 11 shows three capacitors connected to a 10V battery.

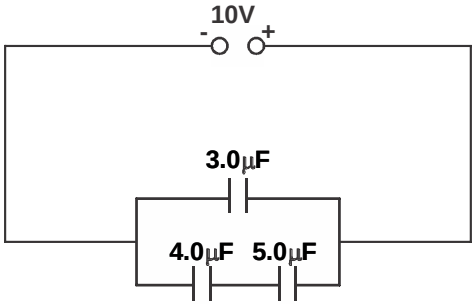


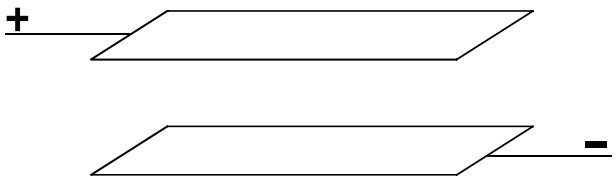
Figure 11

Calculate

i) the combined capacitance of the three capacitors. (3 marks)

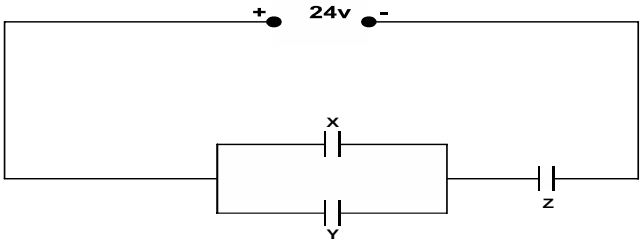
ii) the charge of the 5.0 f capacitor. (3 marks)

6. i)The figure below shows a pair a parallel plates of a capacitor connected to a battery, the upper plate is displaced slightly to the left.



State with reason the effect of this movement on the capacitance. (2 marks)

ii) The figure below shows an electrical circuit with three capacitor **X**, **Y** and **Z** of capacitance 8.0 F, 10.0 F and 6.0 F respectively connected to a 24V battery

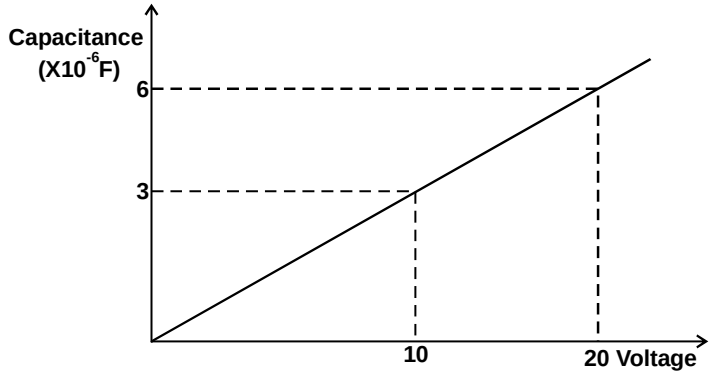


Determine

I. the combined capacitance of the three capacitors. (3 marks)

II. The charge on the capacitor **Z** (2 marks)

iii) The graph below shows the variation of capacitance of a capacitor with voltage supplied across it.

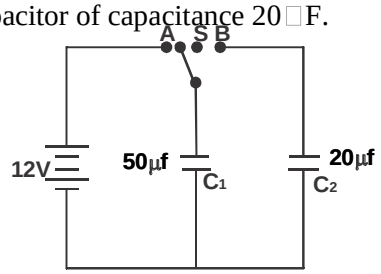


Use the graph to determine the quantity of charge stored in the capacitor. (3 marks)

7. a) i) State the basic law of electrostatics. (1 mark)

ii) In testing for the sign of charge on a body, explain the behaviour of a positively charged electroscope when charged bodies are brought closer to the electroscope. (2 marks)

b) The figure below shows an arrangement which may be used to charge a capacitor of capacitance 50 □F and then to connect it to a capacitor of capacitance 20 □F.



i) The switch S is first placed at position A, so that the capacitor C is connected to the 12V dc supply. Calculate the charge stored in the capacitor. (3 marks)

ii) The switch S is now changed to position B. Calculate the final potential difference across the capacitors. (3 marks)

8. Figure 3 shows a combination of capacitors across a power supply.

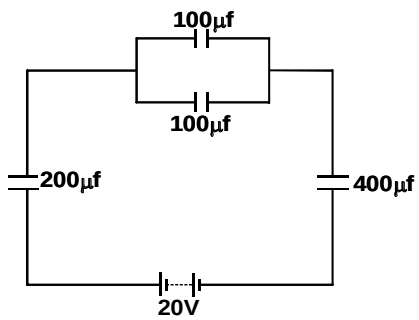
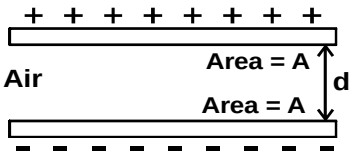


Fig 3

Determine the energy stored in the system of capacitors. (3 marks)

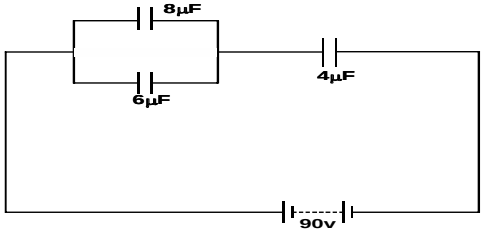
9. (a) The figure shows the charged plates of a parallel plate air capacitor when the distance of separation is d.



Complete the diagram to show the electric field pattern in the space between the plates. (1 mark)

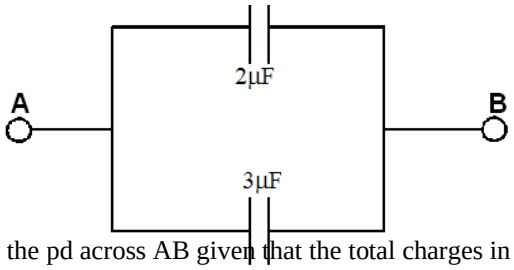
(b) Without changing the area of overlap, suggest two methods by which you would increase the capacitance of a capacitor. (2 marks)

(c) Three capacitors A, B and C are connected as shown in the figure.



Calculate
(i) the charges on each capacitor. (3 marks)
(ii) the potential difference across each capacitor (3 marks)

10. i) State three factors affecting the capacitance of a parallel plate capacitor. (3 marks)
ii) The figure below shows a circuit containing two capacitors of 2μF and 3μF respectively.



Determine the pd across AB given that the total charges in the capacitors is 1×10^{-4} coulombs. (3 marks)

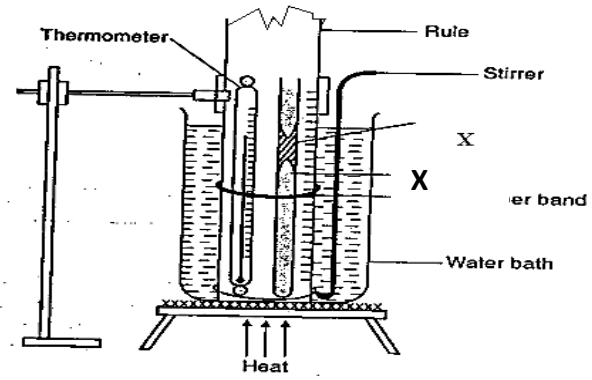
NAME	
ADMISSION NUMBER	

GAS LAWS QUESTIONS

1. State a reason why an air bubble increases in volume as it rises up the surface in a boiler. (1 mark)

2. (a) State Pressure Law (1mark)

(b) The following diagram shows a set up of apparatus used to verify Charles Law.



(i) Give the name of part labelled X (1 mark)
(ii) What is the function of the part named in (i) above? (1 mark)
(iii) Briefly explain how the set up above is used to verify Charles Law (3 marks)

(c) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of $1.5x10^5Pa$ and a temperature of 12^0c. Determine the volume when the temperature is 0^0c at a pressure of $1.0x10^3Pa$. (2 marks)

3. When temperature of a gas in a closed container is raised, the pressure of the gas increases. Explain how the molecules of the gas cause the increase in pressure (2marks

4. A balloon with argon gas of volume $199cm^3$ at the earth's surface where the temperature is 21^0C, and the pressure 760mm of mercury. If it is allowed to ascend to a height where the temperature is 2^0C and the pressure 100mm of mercury, calculate the volume of the balloon. (2 marks)
5. Bubbles of gas escaping from the bottom of a fish pond rises to the surface. It is observed that as bubbles rise, they get larger. Explain this observation. (2mks)

6. a) State the pressure law. (1 mark)
b) The pressure (P) of a fixed mass of a gas at constant temperature T=300k is varied continuously. The corresponding values of P and volume (v) of the gas are shown below.

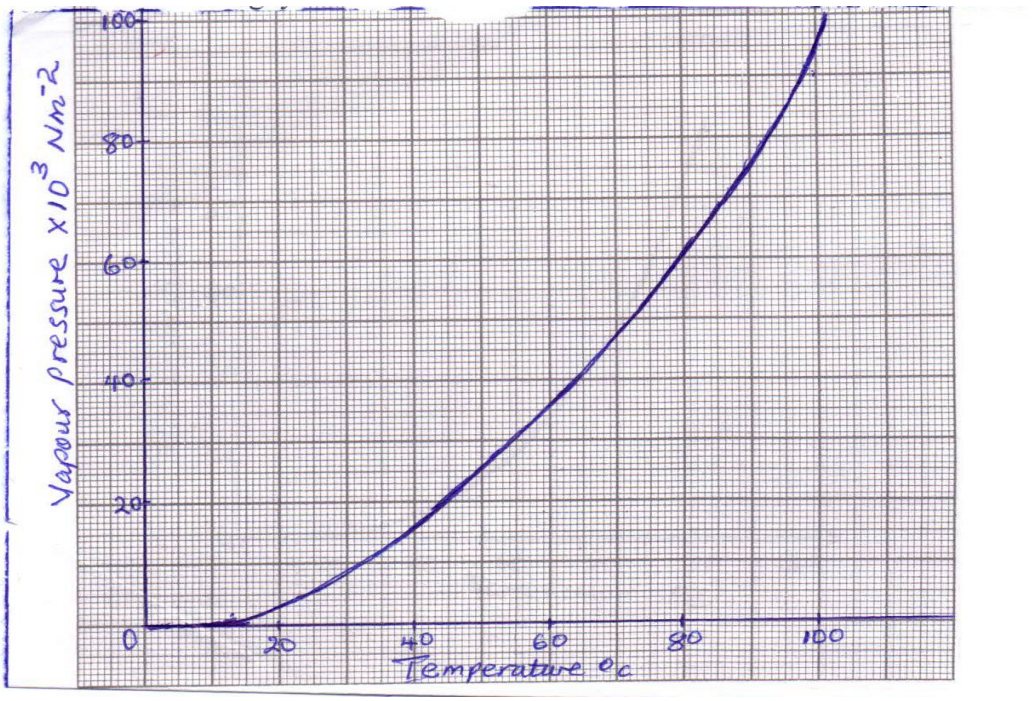
Pressure ($x10^5$ Pa)	2.0	2.5	3.0	3.5	4.0	4.5
Volume (m^3)	0.025	0.02	0.017	0.014	0.012	0.011

(i) Plot a graph of P against $^1/_V$ using grid provided below. (5 marks)
(ii) Given that P = $\frac{2RT}{V}$, Find the constant R from the graph. (2marks)

(b) A tin with an air tight lid contains air at a pressure of 1.0 x 10^5 Pa and a temperature of 12^0C. The air is heated in water bath until the lid opens. If the temperature at which the lid opens is 88^0C,
Determine the pressure attained by the gas. (3marks)

7. (a) When the temperature of water reaches the boiling point, bubbles rise to the surface.
(i) State what is contained in the bubbles. (1mk)
(ii) State the reason why bubbles rise to the surface only at the boiling point. (1mk)

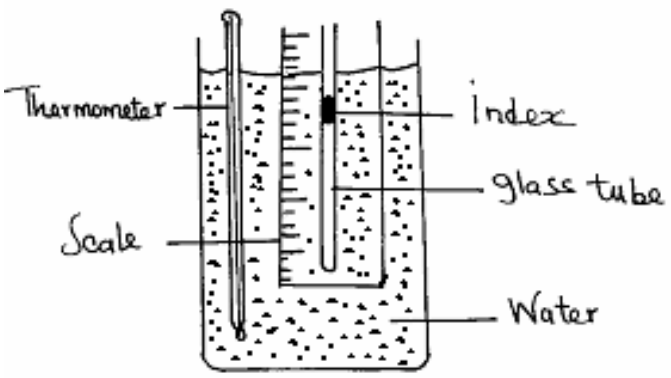
(b) Figure below shows a graph of vapour pressure against the temperature of water vapour at Kerugoya town where mercury barometer indicates a height of 650mm.



(i) Determine the atmospheric pressure of the town in Nm^{-2}.
(Take g = 10m/s² and density of mercury = 13600kg/m³). (3mks)
(ii) Use the graph to determine the boiling point of water in the town. (1mk)

(c) The pressure of helium gas of volume 10cm³ decreases to one third of its original value at constant temperature.
Determine the final volume of the gas. (3mks)

8. The figure below shows a set-up used to investigate Charles Law.

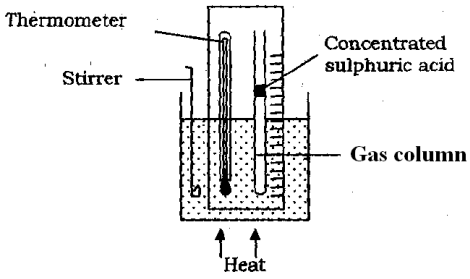


(i) State **one** missing item in the set-up. (1mk)
(ii) Name **two** measurements to be taken in this experiment. (2mks)
(iii) Explain how the measurements stated above may be used to investigate Charles Law. (4mks)

9. When the temperature of a gas in a closed container is raised, the pressure of the gas increases. Explain in terms of kinetic energy how the molecules of the gas cause an increase in pressure. (2mks)

10. (a) An air bubble of volume $0.5cm^3$ when released from the bottom of a lake rises to the surface of the lake.
(i) Explain why the bubble rises up. (2 Mks)
(ii) Calculate the volume of the bubble at the surface of the lake given that the lake is 92.7m deep and the atmospheric pressure is equivalent to 10.3m of water pressure. (4 Mks)
(iii) What assumption have you made in arriving at your answer? (1 Mk)
(b) A fixed mass of gas at constant pressure has a volume of $600cm^3$ at 0^oC. At what temperature will its volume be 1099 cm^3. (3 Mks)

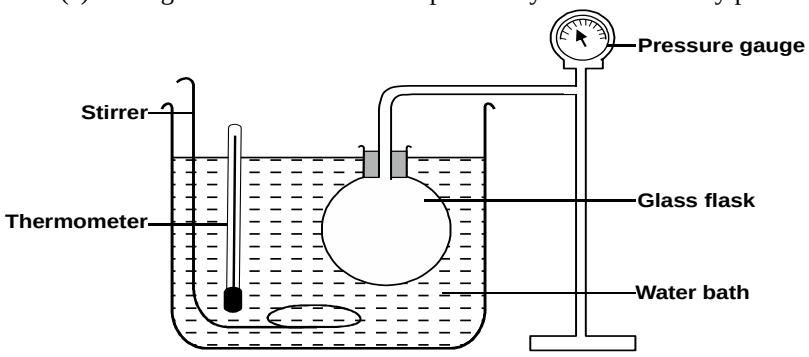
11. (a) What is meant by absolute zero temperature. (1mk)
(b) The figure below shows a set up to investigate the relationship between volume and temperature of a certain gas.



(i) State two factors that are kept constant in order to determine the relationship. (2mks)
(ii) Explain the function of the sulphuric acid. (1mk)
(iii) State the law being investigated in the experiment. (1mk)
(iv) The volume of the gas at 20^0C was found to be $100cm^3$. What would be its volume at 40^0C. (2mks)

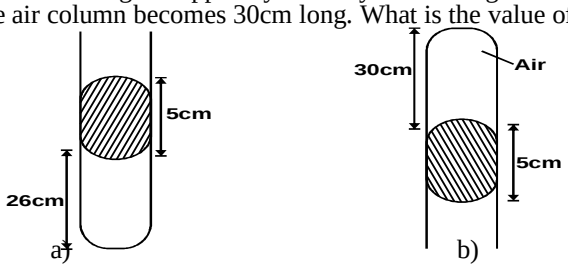
(c) A mixture consist of $40cm^3$ of water and $60cm^3$ of liquid x. If the density of water and liquid x are $1.0g/cm^3$ and $0.8g/cm^3$ respectively, calculate the density of the mixture. (3mks)

12. (a) The figure below shows a set-up that may be used to verify pressure law.



(i) State the measurements that should be taken in the experiment. (2 marks)
(ii) Explain how the measurements in (i) above may be used to verify pressure law. (3 marks)

(b) A column of air 26cm long is trapped by mercury 5.0cm long as shown in the figure (a) below. When the tube is inverted as in figure (b) the air column becomes 30cm long. What is the value of atmospheric pressure. (3 marks)

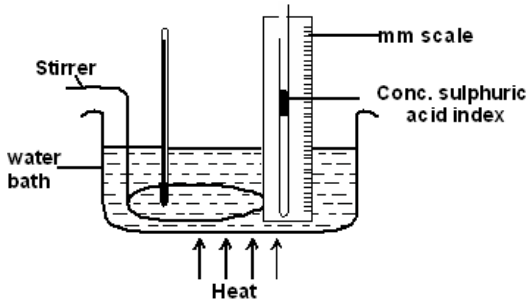


c) A steel cylinder capacity $0.5m^3$ contains nitrogen at a pressure of 30,000 pa when the temperature is 27°C. What will be the pressure of nitrogen if it is allowed to flow into another cylinder of capacity $9.5m^3$ with the temperature reduced to -23°C. (3 marks)

d) State the difference between the temperature measured in Kelvin scale and Celsius scale. (1 mark)

13. In verifying the pressure law of gases, the temperature and pressure of a gas are varied at constant volume. State the condition necessary for the law to hold. (1 mark)

14. **a)**Figure 9 shows a set up to investigate one of the gas laws.



i) Name the gas law being investigated. (1 mark)

ii) Give two reasons for using the concentrated sulphuric acid index. (2 marks)

iii) What is the purpose of the water bath ? (1 mark)

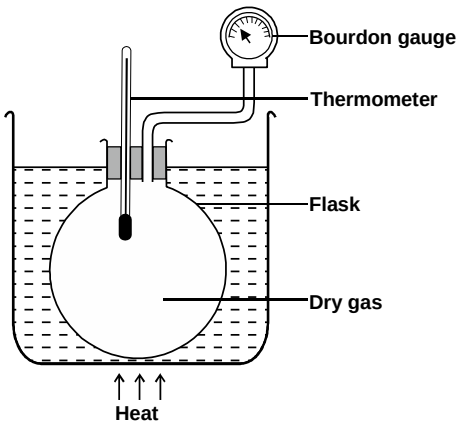
iv) State two measurements that should be taken in this experiment. (2 marks)

v) Explain how the measurements taken in (iv) above may be used to verify the law. (3 marks)

b) A gas has a volume of $30cm^3$ at 18^oC and normal atmospheric pressure. Calculate the new volume of the gas if it is heated to 54^oC at the same pressure. (3 marks)

15. a) What is meant by absolute zero temperature? (1 mark)

b) The set up below was used by a group of form three students to verify pressure law.



Describe briefly how the set-up can be used to verify pressure law. (4 marks)

c)A $4.5cm^3$ bubble released at the bottom of a dam measured $18cm^3$ at the surface of the dam. Work out the depth of the dam taking atmospheric pressure to be 10^5 Pa and the density of water as $1g/cm^3$.(3 marks)

NAME	
ADMISSION NUMBER	

HEATING EFFECT OF ELECTRIC CURRENT QUESTIONS

1. An electric kettle is rated at 1.8 kW, 240 V. Explain the choice of the safest fuse for the kettle. (the available fuses are 5 A, 10 A, and 20 A)
2. A wire of resistance 20Ω is connected to a battery of 12V. Determine the heat dissipated in the wire in one minute. (3 marks)
3. An electric immersion heater rated 240V, 3kW is to be connected to a 240V mains supply, using a 10A fuse. Showing your working, state whether the fuse is suitable or not for circuit. (3 marks)

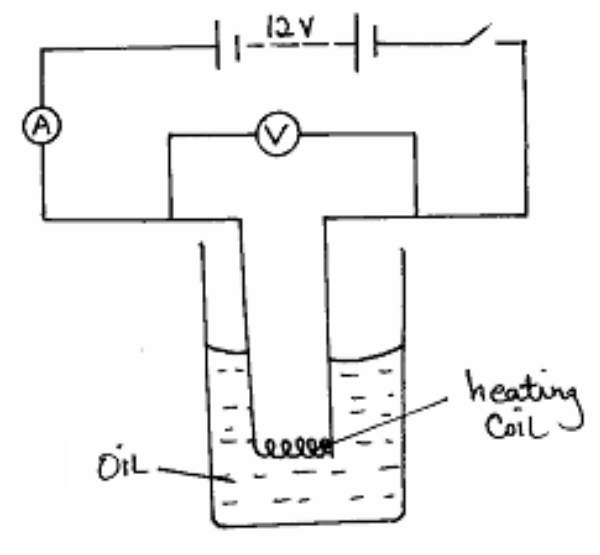
4. A heater of resistance R_1 is rated P watts, V volts while another of resistance R_2 is rated 2P watts, $^{V}/_{2}$ volts. Determine the ratio R_1 to R_2. (3mks)

5. Four 40w bulbs and six 100w bulbs were switched on for 2 hours in the morning and 3 hours at night each day for domestic use in a certain institution. Find the monthly bill for the consumer given that the cost of electricity in the country is at Sh.6.50 per unit. (Take one month to be of 30 days). (3mks)

6. A cooker rated 2.0kW was operated for 40minutes each for 30days. If the cost of each kilo – watt – hour unit is Shs. 15.50, Calculate the cost of electricity used. (4 marks)

7. The figure 4 shows a circuit with a coil used to warm oil in a beaker.

Figure 4



(a) State the Ohm's Law. (1mk)
(b) (i) Explain how heat is produced in the coil. (2mks)
(iii) Given that the reading of the ammeter is 2.5A, determine the resistance of the coil. (3mks)
(iii) How much heat is produced in the coil in a minute? (3mks)
(iv) Give **two** changes that can be made in the set-up in order to produce more heat per minute. (2mks)

8. The element of an electric hot plate has a resistance of 120Ω. What is the energy dissipated when element is kept on for 10 minutes on a 240V supply? (2mks)

9. A hair dryer rated 1000W, 240V runs for 3 hours per day for 7 days. Calculate;
(i)The number of KWh used. (2 Mks)
(ii)The cost of electricity paid at the rate of Ksh 5.50 per unit. (2 Mks)

10. The diagram below shows an electrical appliance connected to the mains.

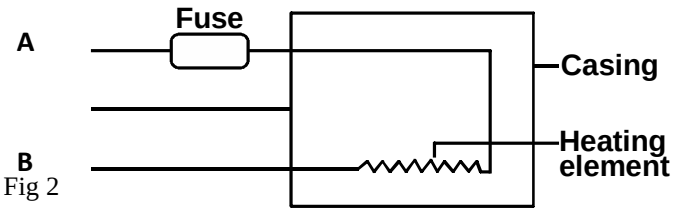


Fig 2

I. Name the colour codes for leads A and B (2 marks)
II. What is the purpose of the fuse? (1 mark)

11. In a laundry four electric irons each rated 750W, 240V are connected to the 240V mains supply using a 13A fuse.
(i)Can the 13A fuse be suitable for the circuit when all the electric ions are being used (support your answer) (2 marks)
(ii)Calculate the cost of using all the electric ions everyday for 3 hours. If the cost of electricity is shs 15.00 pre kilowatt hour. (2 marks)

12. An electric heater is found to have a resistance of 950W when operating normally on a 240V mains. Determine the power rating of the heater. (2 marks)

13. A step up transformer connected to a 40V supply is designed to deliver power to a lamp rated 240V 100W. Given that transformer is 95% efficient, determine the current in the primary winding when the lamp is connected. (3 marks)

14. A current of 13A flows through a heating element of resistance 8.5 for 1.5 minutes. Calculate the quantity of heat supplied. (3 marks)

15. **a)**i) A transformer is connected to an a.c source of 240V to deliver 12A at 120V to a heating coil. If 20% of energy taken from the supply is dissipated in the transformer, calculate the current in the primary coil. (4 marks)

ii) If the wire in the primary coil is charged to have a 2 determine the power dissipated as heat in the coil. (2 marks)

b) A house has three rooms each with two 240V, 60W bulbs. If the bulbs are switched on from 7.00p.m to 10.00pm daily.

i) Calculate the power consumed per day in kilowatt-hours. (3 marks)

ii) Find the cost per week for lighting these rooms at sh.6.30 per kilowatt hour. (2 marks)

c) What is the purpose of earthing in domestic wiring circuit? (1 mark)

16. How much current is taken by a bulb rated 100w, 250V. (2 marks)

NAME	
ADMISSION NUMBER	

LINEAR MOTION QUESTIONS

6. (a) State the physical quantity represented by the gradient of a displacement – time graph (1 mark)

(b) Figure 6 shows the displacement – time graph of the motion of a particle

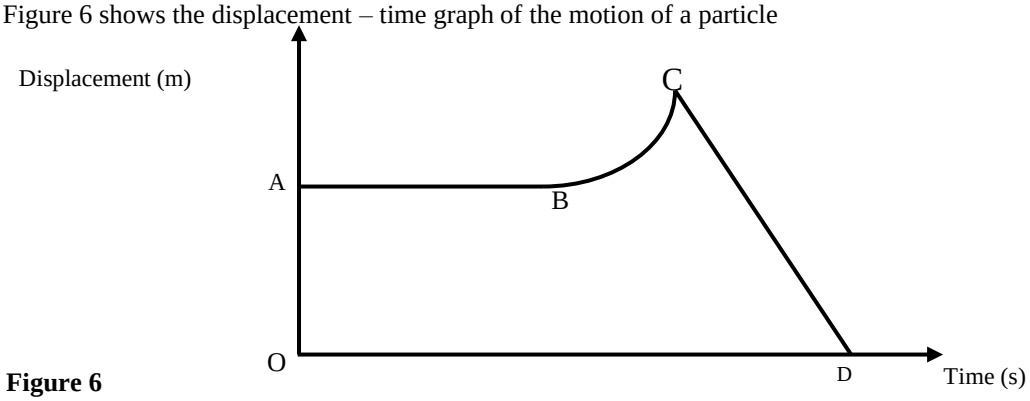


Figure 6

State the nature of the motion of the particle between? (3 marks)

(i) AB

(ii) BC

(iii CD

(c) A car decelerates uniformly from a velocity of 20m/s to rest in 4 seconds. It takes 4 seconds to reverse with uniform acceleration to its original starting point.

(i) Sketch a velocity time graph for the motion of the car. (3 marks)

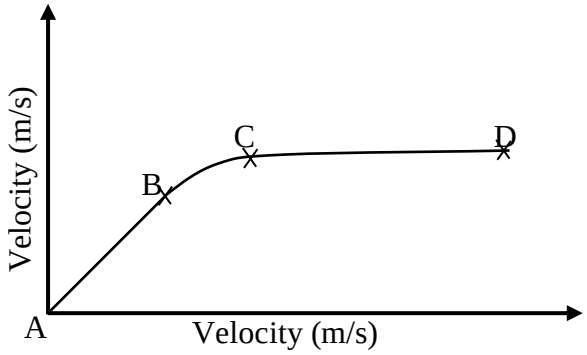
(ii) Use your sketch in c (i) to determine the total displacement of the car. (3 marks)

(d) A ball slides off a horizontal table 4m high with a velocity of 12m/s, find;

(i) the time it takes to hit the floor. (g = 10ms-2) (2 marks)

(ii) the range (2 marks)

7. The figure below shows a sketch graph of velocity-time graph for a body falling through a liquid. Explain the motion of the motion between.

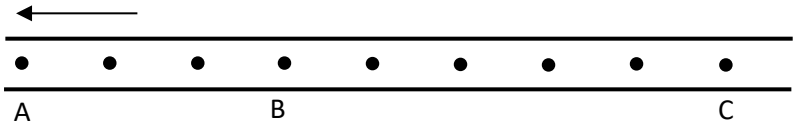


(a) B and C (1 mark)

(b) A and B (1 mark)

(c) C and D (1 mark)

8. (a) The figure below shows dots which were made by a ticker timer – tape attached to a trolley. The trolley was moving in the direction shown.



If the frequency used was 60Hz, distance AB = 12cm and BC = 7.2cm, determine

(i) The velocities between AB and BC (2 marks)

(ii) The acceleration of the trolley. (2 marks)

(b) An object is projected horizontally with a velocity of 40m/s at the top of a cliff 100m from the ground. (Take g = 10m/s^2)

(i) Calculate the time taken for the object to hit the ground (3 marks)

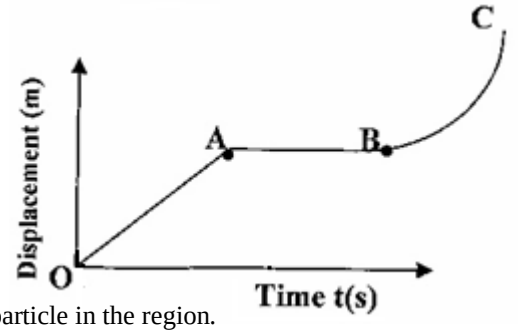
(ii) What is the range of the object from the foot of the cliff (2 marks)

(b) State two assumptions that were made when deriving the equation of continuity? (2 marks)

9. A particle starts from rest and accelerates uniformly in a straight line. After 3 seconds, it is at a distance of 9m from the starting point. Determine the acceleration of the particle. (3mks)

10. A constant force is applied to a body moving with a constant speed. State **one** observable change in the state of motion of the body likely to occur? (1mk)

11. (a) The figure below shows a displacement-time graph of the motion of a particle.



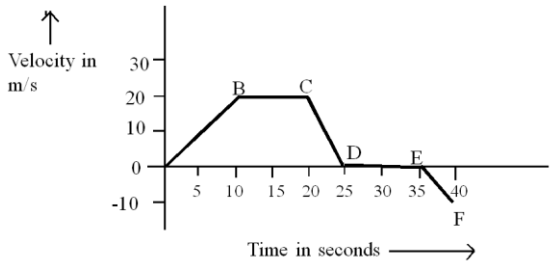
Describe the motion of the particle in the region. (3mks)

(i) **OA**……

(ii) **AB**……..

(iii) **BC**……..

12. The figure 7 below shows a velocity-time graph of a moving body.



Describe the motion of the body over

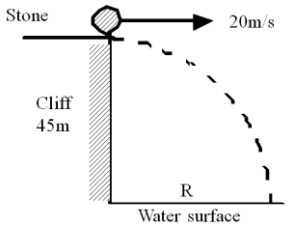
i) region DE (1mk)

ii) region EF

13. A body of mass 5kg is placed at a height 20m above the ground. Calculate the velocity at which it strikes the ground when it is released to fall freely. (2mks)

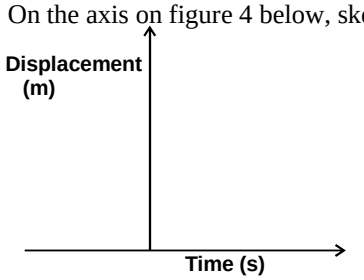
14. Sketch a velocity-time graph for an object thrown vertically upwards until it gets back to it's back to it's initial position. (2mks

15. A stone is released from the top of a cliff 45m high with a horizontal velocity of 20m/s as shown in the figure below.



Calculate:-
(i) the time it takes to hit the water surface. (2mks)
(ii) the velocity with which it hits the water. (2mks)

11. (a)Under what conditions can a feather and a stone released from the same height land on the ground at the same time?
(b) On the axis on figure 4 below, sketch displacement time graph for accelerating body. (1 mark)



12. The figure 8 below shows a tape from a trolley accelerating at 5m/s and the timer is vibrating at 100HZ.

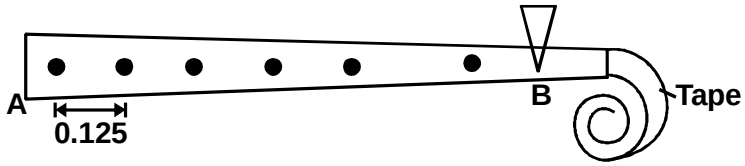
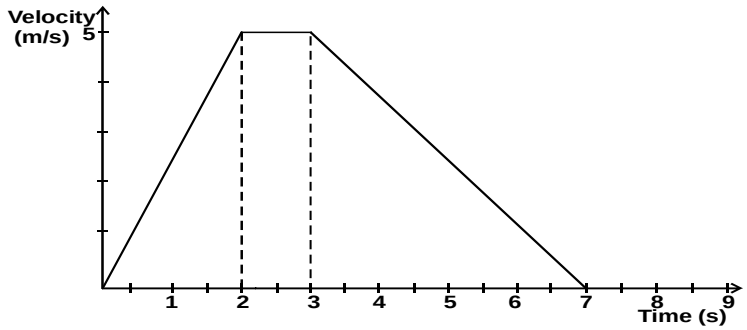


Fig 8
(i) Change in velocity from A to B. (2 marks)
(ii) The final velocity of the trolley. (2 marks)

13. The figure represents the velocity-time graph for a lift in a department store. Use the graph to calculate

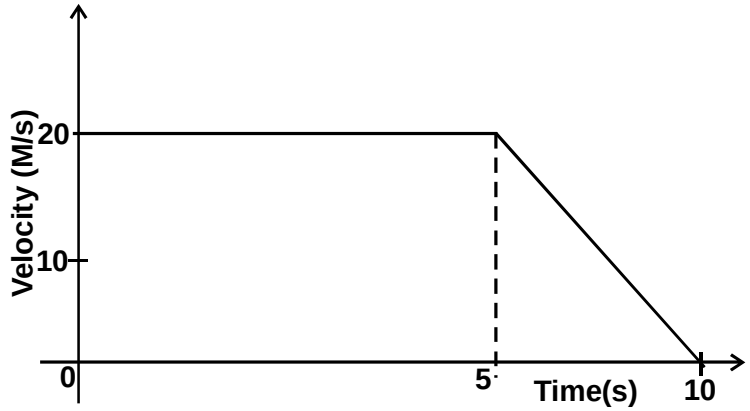


(i) The acceleration of the lift. (1 mark)
(ii) The total distance travelled by the lift. (1 mark)

14. A car runs at a constant speed of 15m/s for 300s and then accelerates uniformly to a speed of 25mls over a period of 20s. This speed is maintained for 300s before the car is brought to rest with uniform deceleration in 30s.
(i) Draw a velocity-time graph to represent the journey described above. (3 marks)

From the graph above
(ii) find the acceleration while the velocity changes from 15m/s to 25m/s (2 marks)
(iii) the total distance travelled in the time described. (2 marks)
(iv) the average speed over the time described. (1 mark)

15. The graph below is a sketch of a velocity-time graph of a car which was travelling at a constant velocity before the brakes were applied. Calculate the distance travelled after the brakes were applied. (3 marks)

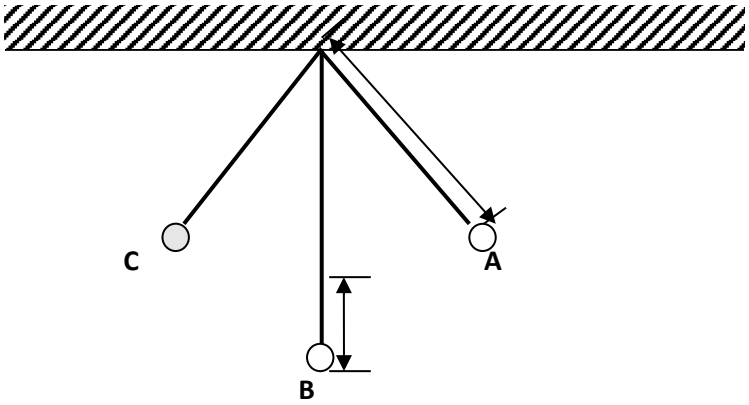


NEWTONS LAWS OF MOTION QUESTIONS

16. A car of mass 800kg is initially moving at 25m/s, calculate the force needed to bring the car to rest over a distance of 20m. (2 marks)

17. A bullet of mass 24g travelling in a horizontal path with a velocity of 450ms^{-1} strikes a wooden block of wood of mass 976g resting on a rough horizontal surface. After impact, the bullet and the block move together for a distance of 7.5m before coming rest.
(a) Name the type of collision which takes place above (1 mark)
(b) What's the velocity of the two bodies when they start sliding (2 marks)
(c) Calculate the force which brings the two bodies to rest (3 marks)
(d) Determine the coefficient of friction between the block and the surface during this motion. (2 marks)

18. The figure below shows a simple pendulum of length 80 cm. the pendulum bob whose mass is 50 g oscillates between points A and B, through its rest position C. A and B are both 10 cm higher than C

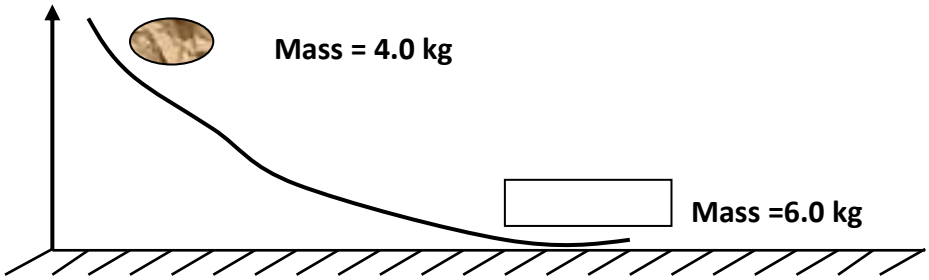


(a) (i) indicate with an arrow, on the path ACB, the direction of the greatest velocity of the bob as it moves from A to B. (1mk)
(ii) State the form of energy possessed by the pendulum bob at point A (1 mark)

(b) Determine
(i) The velocity of the bob at point C (2 marks)
(ii) The tension in the string as the bob passes point C (2 marks)
(Take acceleration due to gravity g=10m/s^2

(c) State two characteristics of perfectly inelastic collisions (2 marks)

(d) A body of mass 4.0 kg held at a vertical height of 500cm is released to travel along a frictionless curved path as shown in the figure below.



The 4.0kg mass strikes body of mass 6.0kg at rest immediately it reaches the horizontal. The bodies stick together and move in the same direction. Determine the velocity of the bodies immediately after collision. (4 marks)

19. (a) State Newton's second law of motion in terms of in momentum. (1mk)

(b) A trolley of mass 5kg travelling to the right at 2m/s collides heads on with another trolley of mass 3kg travelling at 4m/s to the left. Find their velocity after collision if the collision is perfectly inelastic. (3mks)

(c) A bullet of mass 2g is fired with a velocity of 300m/s into a wooden block of mass 5kg suspended from a long string. The bullet sticks into the wood and the two moves together.
(i) Find the velocity of the block and the bullet immediately after collision took place. (3mks)
(ii) Calculate the height to which both swings upwards. (3mks)

20. A bullet moving at a velocity of 350m/s hits a tree trunk of diameter 70cm. It emerge from the opposite side with a velocity of 180m/s. Determine the average deceleration of the bullet in the trunk. (3 marks)

21. The table below shows the value of the resultant force F and time t for a bullet raveling inside the gun barrel after the trigger is pulled.

Force F (N)	360	340	300	240	170	110
Times t (ms)	3	4	8	12	17	22

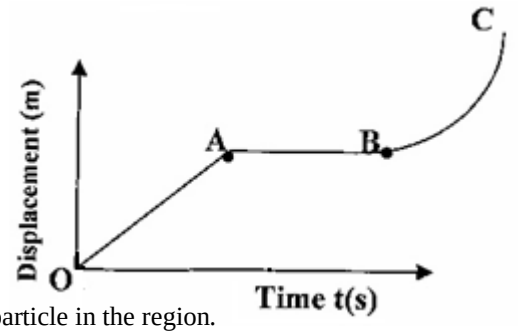
(a) On the grid provided plot a graph of force F against time t. (5 marks)

(b) Determine from the graph:
(i) The time required for the bullet to travel the length of the barrel assuming that the force becomes zero just at the end of the barrel. (1 mark)
(ii) Impulse of the force. (2 marks)

(c) Given that the bullet emerges from the muzzle of the gun with a velocity of 200m/s, Calculate the mass of the bullet. (3marks)

22. A constant force is applied to a body moving with a constant speed. State **one** observable change in the state of motion of the body likely to occur? (1mk)

23. (a) The figure below shows a displacement-time graph of the motion of a particle.



Describe the motion of the particle in the region. (3mks)

(iv) **OA**……

(v) **AB**……..

(vi) **BC**……..

(b) A hot air balloon falling through the air attains terminal velocity after a short-time. State the reason why it attains terminal velocity. (1mk)

(c) State Newton's second law of motion. (1mk)

(d) A ball of mass 0.2kg is thrown vertically upwards with velocity of $8ms^{-1}$. The air resistance is 0.5N. Determine:

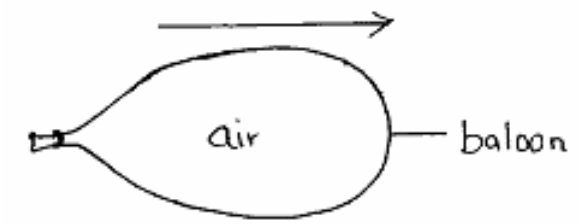
(i) the resultant force on the ball as it moves up;
(Take acceleration due to gravity $g = 10ms^{-2}$). (2mks)

(ii) The acceleration of the ball. (3mks)

(iii) The maximum height reached by the ball. (2mks)

24. (a) Give a reason why the inside of a helmet is lined with sponge. (1mk)

(b) The figure below shows a balloon filled with air.



When the mouth is suddenly opened, the balloon moves in the direction shown above by the arrow. Explain that observation. (2mks)

(c) A rock of mass 150kg moving at 10m/s collides with a stationary rock of mass100kg. They fuse after collision. Determine the

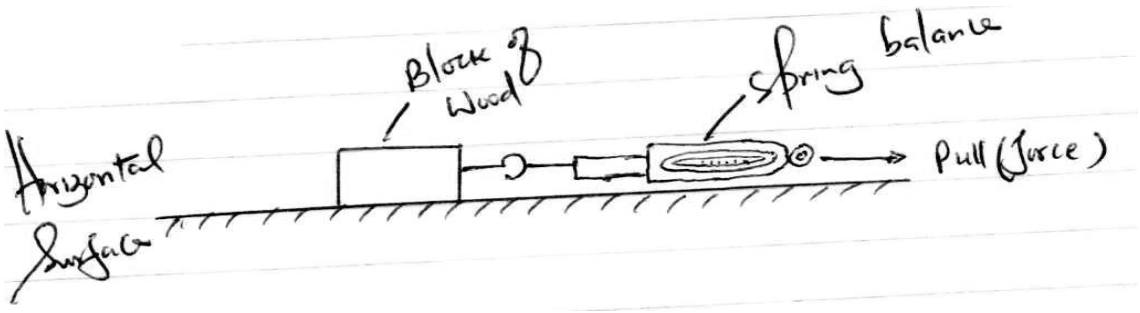
(i) Total momentum before collision. (2mks)

(ii) Total momentum after collision. (1mk)

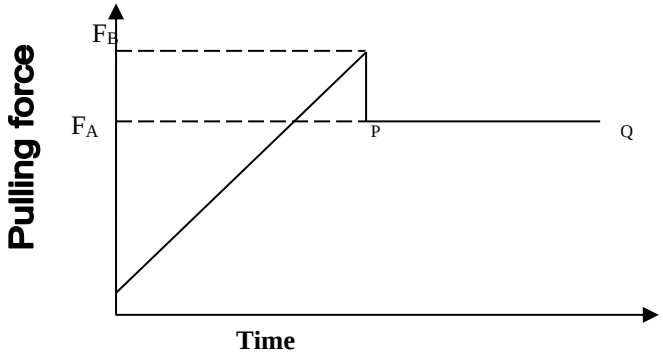
(iii) Their common velocity after collision. (2mks

25. (a) State **<u>two</u>** factors that influence fractional force between two surfaces.

(b) Figure below shows a rectangular block of wood attached o a spring balance being pulled gently by a pulling force P at a steady velocity.



i.A graph of pulling force against time was drawn as shown below.



I. State the forces F_A and F_B.

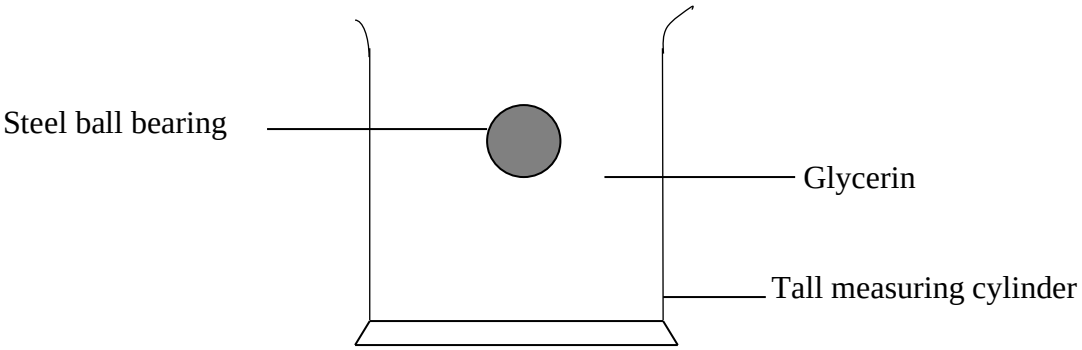
F_A :…… (1mk)

F_B :…… (1mk)

II. From the graph, state what happens to the block of wood between point P and Q. (1mk)

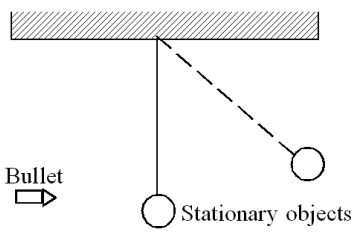
ii. Given that the wooden box has a mass of 2.0kg and requires force of 5N to pull it with uniform speed along a horizontal surface, calculate the coefficient of friction between the surface and the block. Take (g = 10N/kg (3mks)

(c) Figure below shows a steel bearing moving through glycerine at a steady velocity.



Indicate on the diagram the forces with directions acting on the ball bearing. (2mks)

26. (a) A bullet of mass 20g moving with a velocity of 100m/s embed on a stationery object of mass 900g suspended so that it can swing freely as shown in the figure below.



Determine

i) the velocity of the bullet and block immediately after collision. (3mks)

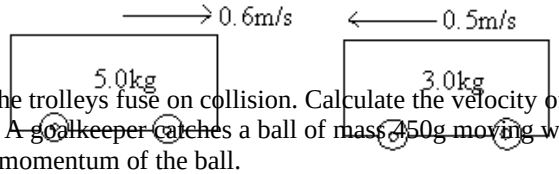
ii) the height through which the block rises. (3mks)

(b) A train travelling at 100km/h increases its velocity to 132km/h in 8 minutes. Calculate its acceleration in m/s. (3mks)

27. A bullet of mass 10g is fired at 200m/s from a pistol of mass 1.0kg. What is the recoil velocity of the piston. (2mks)

28. A body of mass 5kg is placed at a height 20m above the ground. Calculate the velocity at which it strikes the ground when it is released to fall freely. (2mks)

29. The figure below shows two trolleys of mass 5.0kg and 3.0kg travelling towards each other at 0.60m/s and 0.5m/s respectively.



If the trolleys fuse on collision. Calculate the velocity of the combined trolleys. (2mks)

(ii) A goalkeeper catches a ball of mass 450g moving with a velocity of 20m/s. Determine

(I) momentum of the ball. (2mks)

(II) the average force applied by the goalkeeper hands to stop the ball in 0.4 seconds. (2mks)

30. A stone thrown vertically upwards from the base of a mountain with an initial velocity of 100m/s. The stone just stopped as the apex and came back. Another boy projected a stone horizontally from the top of the mountain. Calculate:

(a) Height of the mountain. (2 marks)

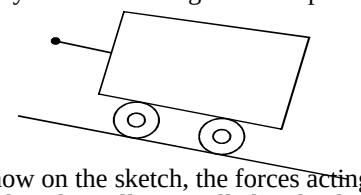
(b) Time taken for the stone to follow the trajectory. (2 marks)

(c) The range if the horizontal velocity is 20m/s. (2 marks)

(d) Calculate the impulse of force produced when a table is pulled for 3 seconds by a constant force of 10N towards the right and then for 2 seconds by a constant force of 20N towards the left. (2 marks)

31. (a)An object which is moving over a horizontal surface slows down until the motion finally gets to zero. Explain what is responsible for this observation. (1 mark)

(b) A trolley of mass 5.00 kg rests at a plain horizontal shown below.



(i) Show on the sketch, the forces acting on it when pulled in one direction. (4 marks)

(ii) When the trolley is pulled with a horizontal force of 24N, the trolley accelerates at $3m/s^2$. Find the frictional force acting on the trolley. (2 marks)

(c) An automobile of mass 500 kilograms is accelerated from rest along a horizontal surface. The force produced by the engine is 300N and that due to friction is 50N. What is the accelerated force and what is the acceleration produced? (2 marks)

32. a) What is meant by perfectly inelastic collision. (1 mark)

b) A minibus of mass 1600 kg travelling at a constant velocity of 20mls collides with a stationary car of mass 800kg. The impact takes 2 seconds before the two move together and come to rest after 15 seconds.

Determine

i)The common velocity. (3 marks)

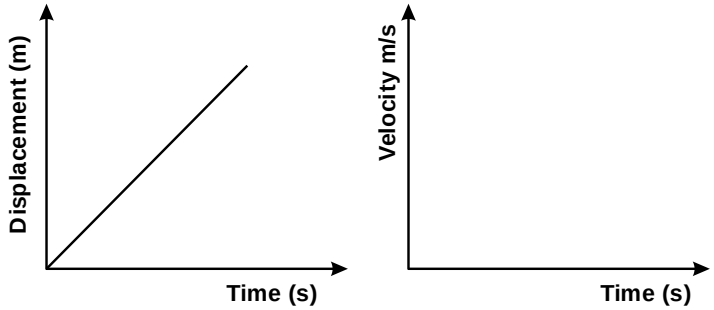
ii) The distance moved after the impact. (3 marks)

33. A students pulls a block of wood along a horizontal surface by applying a constant force. State the reasons why the block moves at a constant velocity. (1 mark)

34. A force of 200N is applied on a 10kg block on a horizontal surface. The body attains an acceleration of 16m/s^2. Determine the coefficient of friction between the block and the surface. (3 marks)

20. a) What is the meaning of term uniform acceleration ? (1 mark)

b) The motion of a body is described by the graph shown in the figure 6(a).



Sketch a velocity-time graph for the motion on the set of axes in figure 6(b) (1 mark)

c) A body of mass 0.5kg falls from an 80m tall building and penetrates to the ground to a depth of 20cm. Determine :

i) The velocity at which the body strikes the ground. (3 marks)

ii) The average retardation as the body penetrates the ground. (3 marks)

iii) The retarding force on the body. (2 marks)

21. A train of mass 400 tonnes starts from rest and accelerates uniformly at 1.5ms^{-2}. Determine the momentum after moving 400m. (2 marks)

NAME	
ADMISSION NUMBER	

QUANTITY OF HEAT

1. State a reason why more energy is required to change ice from 0^0C to water at 1^0C, than to change equal mass of water from 0^0C to 0^0C. (1 mark)

2. (a) Distinguish between boiling and evaporation. (2 marks)

(b) A solid of mass 1kg was heated uniformly by a 100W heating element until it melts. The graph in figure 5 shows the variation of temperature with time.

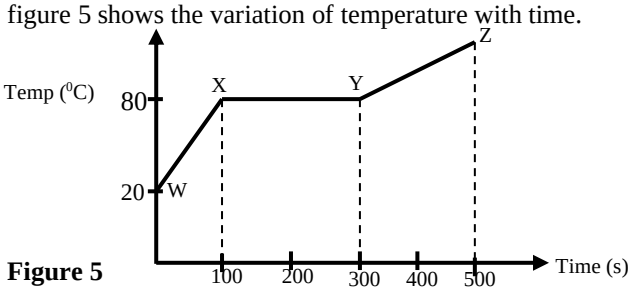


Figure 5

(i) Explain what is happening in the regions

WX:

XY:

(ii) Calculate the specific heat capacity of the solid. (3 marks)

(iii) Calculate the specific latent heat of fusion of the solid (2 marks)

(c) A substance of mass 2kg and specific heat capacity 400Jkg^{-1}k^{-1} initially at 80^0C is immersed in water at 19^0C. If the final temperature of the mixture is 20^0C. Calculate the mass of water. (Specific heat capacity of water = 4200Jkg^{-1}k^{-1})
(3 marks)

3. (a) What is meant by specific latent heat of fusion of a substance? (1mark)

(b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100ºC was passed into water contained in a well-lagged copper calorimeter. The following measurements were made:

- Mass of calorimeter = 60g
- mass of water + calorimeter = 145g
- Final mass of calorimeter + water + condensed steam = 156g
- Final temperature of the mixture = 48ºC

[Specific heat capacity of water = 4200JKg^{-1}k^{-1} and specific heat capacity of copper = 390JKg^{-1}k^{-1}]
Determine the;

(i) mass of condensed steam. (1mark)

(ii) The heat gained by the water and calorimeter if the initial temperature of the calorimeter and water is 20ºC. (3marks)

(iii) Given that $\mathbf{L_v}$ is the specific latent heat of vaporization of steam, write an expression for the heat given out by steam. (1mark)

(iv) Determine the value of $\mathbf{L_v}$ above (2marks)

(v) State the assumption made in the above experiment (1 mark)

4.

(a) Define the term heat capacity (1mark)

(b) A block of metal of mass 150g at 100ºC is dropped into a logged calorimeter of heat capacity $40Jk^{-1}$ containing 100g of water at 25ºC. The temperature of the resulting mixture is 34ºC. (Specific heat capacity of water = 4200J/KgK)

Determine;-

(i) Heat gained by calorimeter (2mks)

(ii) Heat gained by water (1mark)

(iii) Heat lost by the metal block (1mark)

(iv) Specific heat capacity of the metal block (3marks)

(b) Differentiate between boiling and evaporation (2mark)

5. (a) Define specific latent heat of fusion (1 mark)

(b) Given the following. A filter funnel, a thermometer, a stop watch, ice at 0^0C, an immersion heater rated P watts, a beaker, a stand, boss and clamp and weighing machine.Describe an experiment to determine the specific latent heat of fusion of ice. Clearly state the measurements to be made. (4 marks)

(c) 200g of ice at 0^0C is added to 400g water in a well lagged calorimeter of mass 40g. The initial temperature of the water was 40^0C. If the final temperature of the mixture is X^0C, (Specific latent of fusion of ice L = $3.36 \times 10^5 JKg^{-1}$, specific heat capacity of water, c = $4200Jkg^{-1}K^{-1}$, specific heat capacity of copper = $400Jkg^{-1}K^{-1}$)

(i) Derive an expression for the amount of heat gained by ice to melt it and raise its temperature to X^0C (2 marks)

(ii) Derive an expression for the amount of heat lost by the calorimeter and its content when their temperature falls to X^0C. (2 marks)

(iii) Determine the value of X. (3 marks)

6. a) Explain why a drop of methylated spirit on the back of the hand feels colder than a drop of water at the same temperature. (2mks)

(b) A block of metal of mass 150g at 100°C is dropped into a lagged calorimeter of heat capacity 40J/k containing 100g of water at 25°C. The temperature of the mixture is 34°C. (s.h.c of water = 4200J/kgK).

Determine:

(i) Heat gained by the calorimeter. (2mks)

(ii) Heat gained by water. (2mks)

(iii) Heat lost by the metal block. (2mks)

(iv) Specific heat capacity of the metal block. (3mks)

(c) A student heated some water and noticed that it boiled at 102ºC. State **one** possible reason for this observation. (1mk)

7. a) A liquid at 80º in a cup was allowed to cool for 20 minutes. State two factors that determine the final temperature. (2 marks)

b) What is meant by specific latent heat of evaporation? (1 mark)

c) In an experiment to determine the specific latent heat of vaporization L of water, steam at 100ºC was passed into water contained in a well lagged copper calorimeter. The following

Measurements were made:

Mass of calorimeter = 80g

Initial mass of water = 70g

Initial temperature of water = 5ºC

Final mass of calorimeter + water + condensed steam = 156g

Final temperature of mixture = 30ºC

(Specific heat capacity of water = $4200JKg^{-1}k^{-1}$ and specific heat capacity for copper =390J/kg/k)

Determine:

(i) Mass of condensed steam. (2 marks)

(ii) Heat gained by the calorimeter and water. (2 marks)

(iii) Given that L. is the specific latent host of vaporization of steam.

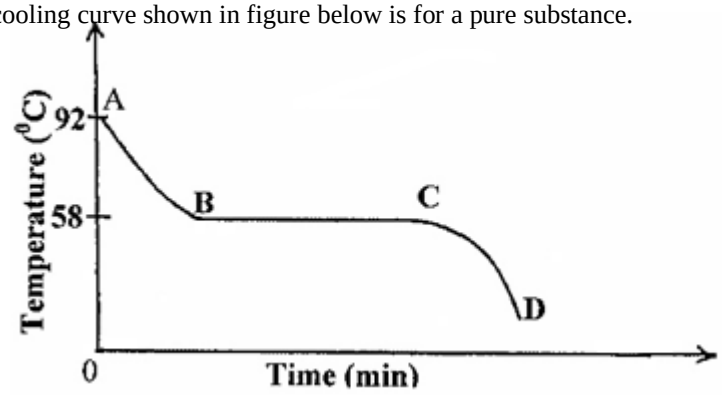
a) Write an expression for the heat given out by steam. (1 mark)

b) Determine the value of L. (3marks)

8. (a) (i) Define the term latent heat of fusion. (1mk)

(ii) 9816J of heat energy is required to completely convert m kg of ice at 0°C to steam. Determine the value of m. (Take latent heat of fusion of ice = 2.34 x 10^{5}Jkg^{-1}; specific heat capacity of water = 4200Jkg^{-1}k^{-1}, latent heat of vaporization of steam = 22.26 x 106Jkg^{-1}). (4 marks)

(b) The cooling curve shown in figure below is for a pure substance.



(i) What is the melting point of the substance? (1mk)

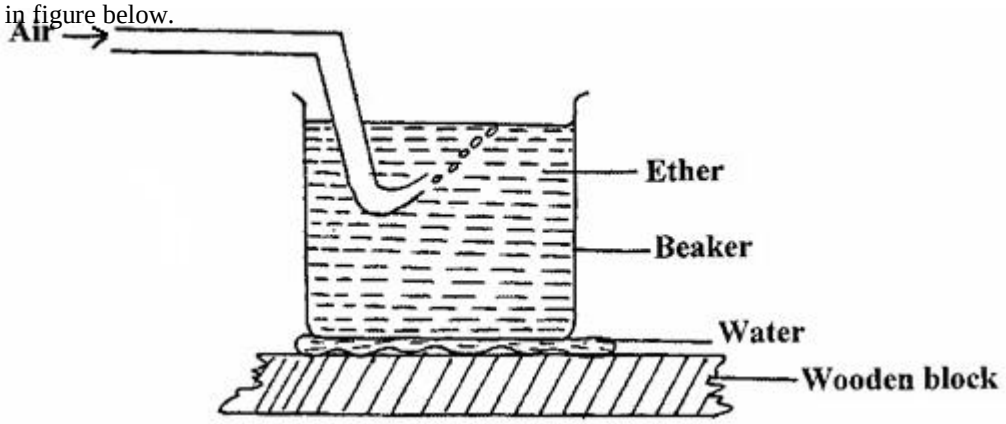
(ii) Explain what happens in the region. (3mks)

I **CD**……

II **AB**……

III **BC**……

(c) A beaker containing ether was placed on some water on a wooden block. Air was then blown through the ether using a pump as shown in figure below.



State and explain what observation is made after sometime. (2mks)

9. (a) A certain powder of mass 100g was heated in a container by an electric heater rated 100w for some time. The graph below shows the variation of the temperature of the powder with time.

Use the graph to:

(i) Determine the melting point of the powder …… (1mk)

(ii) Determine the quantity of heat supplied by the heater from the time the powder starts to melt to the time it has melted. (3mks)

(iii) Determine the specific latent heat of fusion of the powder assuming the container absorbs negligible amount of heat. (3mks)

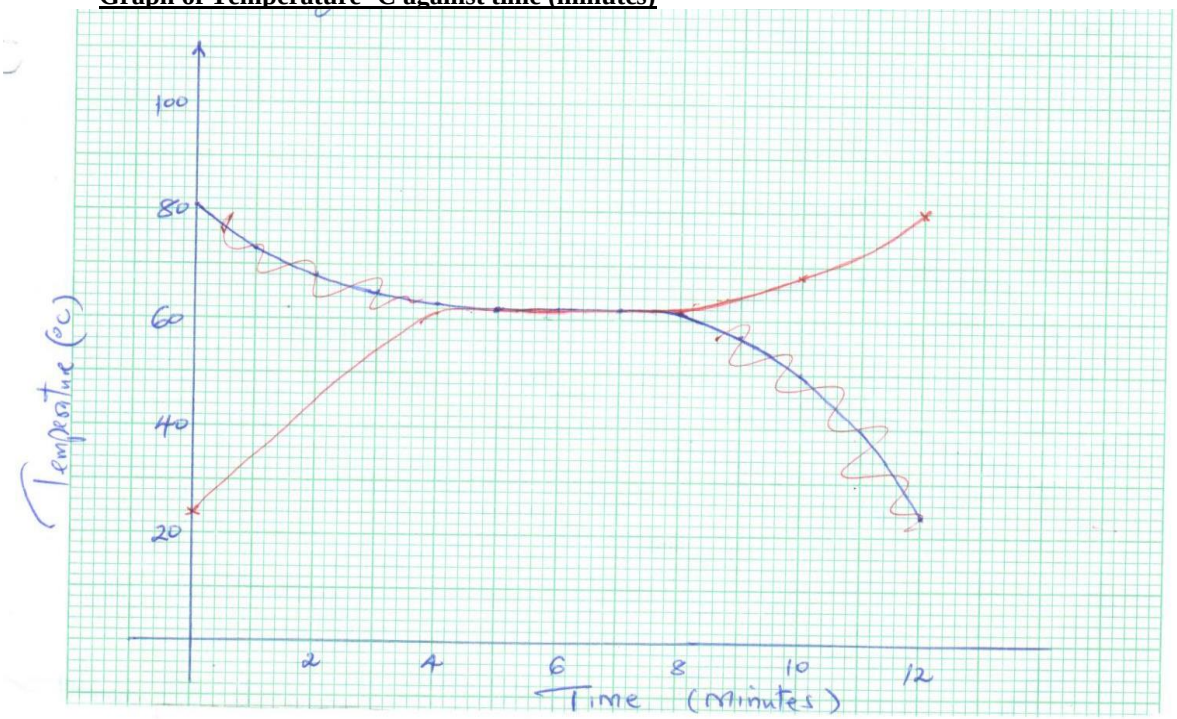
(b) State **one** application of cooling caused by evaporation. (1mk)

(b) Water of mass 2kg at 100°C is allowed to cool for 20 minutes. State **two** factors that determine the final temperature. (2mks)

10. (a) State any **two** factors that affect the melting point of a liquid. (2mks)

(b) 600g of a solid X was heated by an electric heater rated 500W until it melted, temperature readings taken as it heats from room temperature. The graph shown below shows variation of temperature against time.

Graph of Temperature ^{0}C against time (minutes)



(a) From the graph, determine the melting point of the solid X. (1mk)

(b) I. Determine the heat supplied by the heater for solid X to melt. (2mks)

II. Hence determine the specific latent heat of fusion for solid X. (2mks)

(c) I. State the room temperature. (1mk)

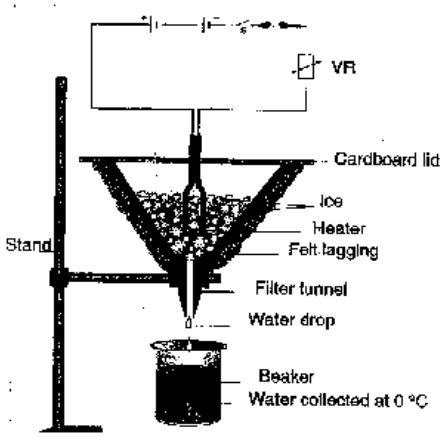
II. From the graph, determine the temperature change between the time t = 0 minutes and t = 4.0 minutes. (2mks)

III. Hence determine the specific heat capacity of the solid X. (3mks)

11. A block of metal of mass 5 kg is heated to 1100 and then gently immersed in 2kg of water in a container of negligible heat capacity. The final temperature of water is found to be 50^0C. What was the initial temperature of the water? Specific heat capacity of metal = 840jKg^{-1}K^{-1} Specific heat capacity of water = 4200jKg^{-1}K^{-1} (3mks)

12. (a) Define the term specific latent heat of fusion. (1mk)

(b) The figure below show an incomplete set up that can be used in an experiment to determine the specific latent heat of fusion of ice by electric method.



Specific latent heat of fusion of ice

i) Complete the diagram by inserting the missing components for the experiment to work. (2mks)

ii) The following readings were noted after the heater was switched on for 10 minutes.

Mass of the beaker	150g
Mass of beaker + melted ice	200g
Current through the heater	2A
Voltage across the heater	15V

Determine the

(I) Energy supplied by the heater in the 10 minutes. (2mks)

13. (a) What is meant by term specific latent heat of vaporization? (1 mark)

(b) In an experiment to determine the specific latent heat of vapourisation of water, steam at 100°C was passed into water contained in a well lagged copper calorimeter. The following measurements were made :-

Mass of calorimeter = 50g

Initial mass of water 70g

Initial temperature of water = 5°C

Final mass of water + Calorimeter + condensed steam = 123g

Final temperature of mixture = 30°C

Specific heat capacity of water = $4200jKg^{-1}k^{-1}$

Specific heat capacity of copper = $392jKg^{-1}k^{-1}$

I. Determine the:-

(i) Mass of condensed steam. (1 mark)

(ii) Heat gained by water and calorimeter. (2 marks)

II. Given that L is the specific latent heat of vaporization of steam.

(i) Write an expression for the heat given out by steam. (1 mark)

(ii) Determine the value of L. (3 marks)

III. The specific latent heat of fusion of ice is 334J/g. Explain what this means. (1 mark)

IV. The specific heat capacity of pure water is 4200J/ kg /k while that of sea water is 3900J/kg/k. Which of the two liquids is the most appropriate to be used in cooling systems. Give a reason. (2 marks)

14. (a) Define the term specific heat capacity of a substance. (1 mark)

(b) In an experiment to determine the specific latent heat of vaporisation of water, stream at 100°C was passed into water contained in a well lagged copper calorimeter.

The following measurements were obtained.

Mass of calorimeter = 52g

Initial mass of water = 72g

Initial temperature of water = 6°C

Final mass of water + calorimeter + condensed steam = 127g

Final temperature of mixture = 34°C

(Specific heat capacity of water = 4200J/kgk)

(Specific heat capacity of copper = 390J/kgk)

Determine

(i) Mass of condensed steam. (2 marks)

(ii) Heat gained by water and calorimeter. (2 marks)

(iii) Given that L_V is the specific latent heat of vaporization of steam, write an expression for the heat out by steam. (1 mark)

(iv) Determine the value of L. (2 marks)

15. (a) State the unit specific latent heat of a substance. (1 mark)

(b) In an experiment to determine specific heat capacity of liquids, a student used 2.0 kg each of the liquids water glycerine and paraffin. Each of the liquids was supplied with 21600J of heat energy under the same conditions. The table below shows the temperature rise for the liquids.

Liquid	Water	Glycerine	Paraffin
Temperature rise (°C)	2.6	4.4	4.9

(i) Suggest a reason for the difference in the rise in temperature. (1 mark)

(ii) Calculate the specific heat capacity of paraffin. (3 marks)

(a) 5g of water at 20°C is heated until it boils at 95°C. On further heating, the temperature of the water does not change until it has all vapourised. Calculate the amount of heat required to convert all the 5g of water to steam, given that the latent heat of vaporisation of water is 2.26×10^6 J/kg and specific heat capacity of water is 4200J/kg°C (4 marks)

(b) State one physical property of a good thermometric medium which may be used to measure temperature. (1 mark)

REFRACTION OF LIGHT QUESTIONS

12. The following figure 4 shows the path of a ray of light through a transparent material placed in air.

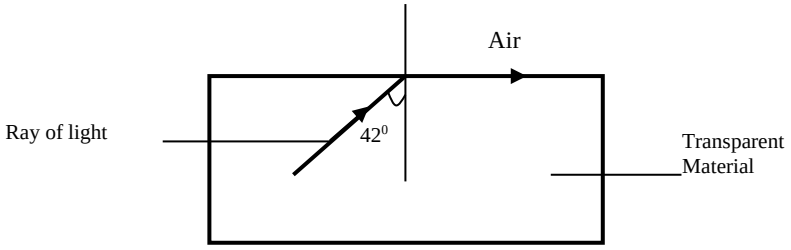


Fig. 4

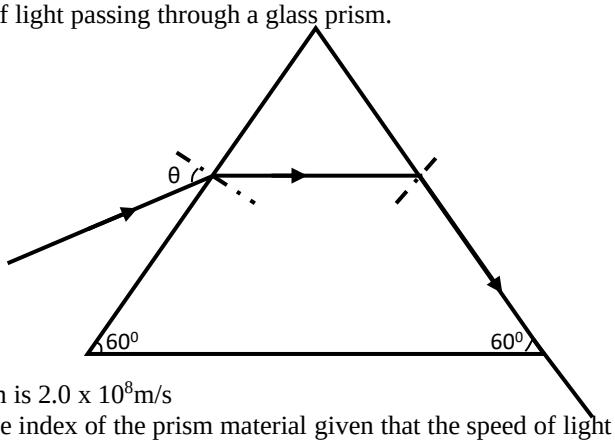
Determine the refractive index of the transparent material (2 marks)

13. (a) A coin is placed at the bottom of a tall jar. The jar is filled with paraffin to a depth of 32.4 cm and the coin is apparently seen displaced 9.9 cm from the bottom. Determine the refractive index of air with respect to paraffin.(3marks)

(b) Define the term **critical angle**. (1mark)

(c) **Figure 6** shows a ray of light passing through a glass prism.

Figure 6



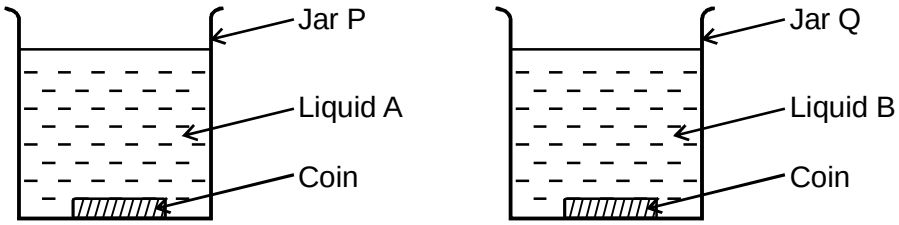
If the speed of light in prism is 2.0 x 10^8m/s

(i) Determine the refractive index of the prism material given that the speed of light in air is 3.0 x 10^8m/s. (2marks)

(ii) Determine the value of the critical angle c and show it on **Figure 6**. (2marks)

14. (a) Two coins were placed at the bottom of two jars each containing a different clear liquid as shown in **figure 7**.

Fig 7



The liquids in the two jars are at the same level. The coin in jar Q appears shallower than that in jar P. Explain. (2 marks)

(b) The **figure 8** shows a ray of light incident on a water-air interface from a source 8m deep.

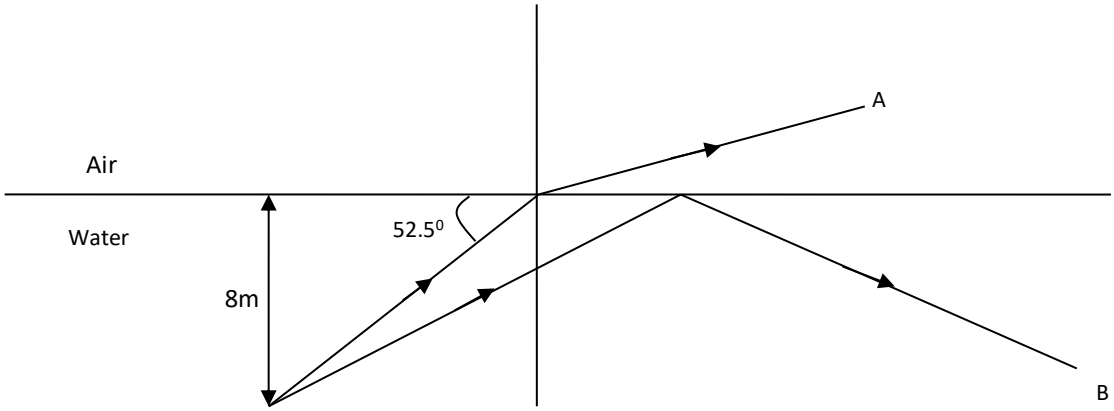


Fig 8

(i) Ray A is observed to bend as it enters the air. Give a reason why this occurs. (1 mark)

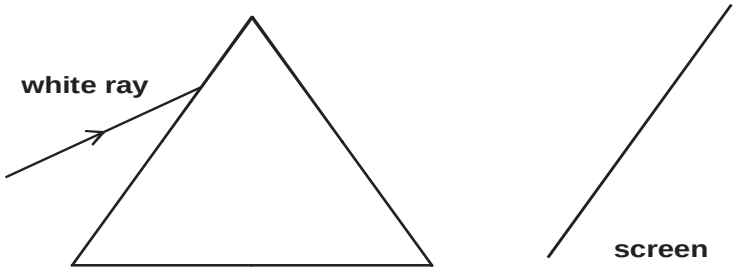
(ii) If the refractive index of water is 1.35, calculate the angle of refraction of ray A (3 marks)

(iii) Find the critical angle of water. (3 marks)

(iv) Give a reason why ray B is not travelling out of water. (1mark)

(c) **Figure 9** below shows a ray of light incident on a triangular prism and a white screen is placed in front of the prism.

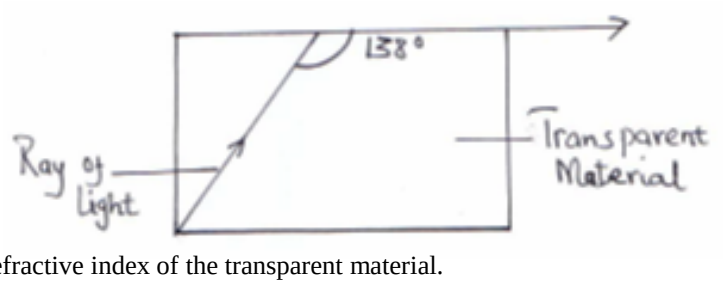
Fig 9



Complete the diagram to show the path followed by the ray up to the screen. (2 marks)

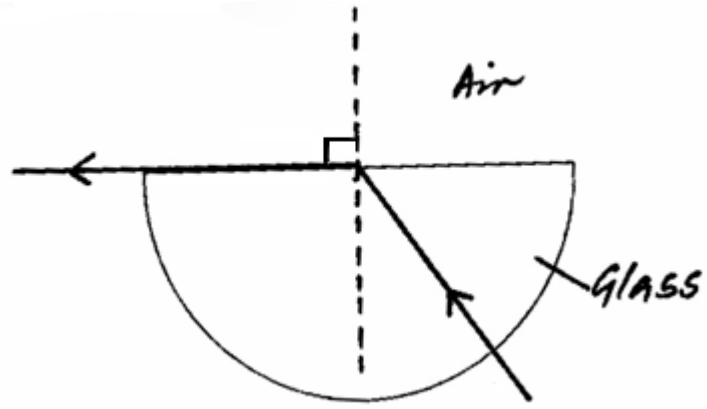
15. A ray of light makes an angle of 35^0 with the glass surface. Calculate the total distance the ray covers through a glass of refractive index 1.45, given that the width of the glass is 6cm. (3 marks)

16. Figure 6 below shows the path of light through a transparent material placed in air.



Calculate the refractive index of the transparent material. (3mks)

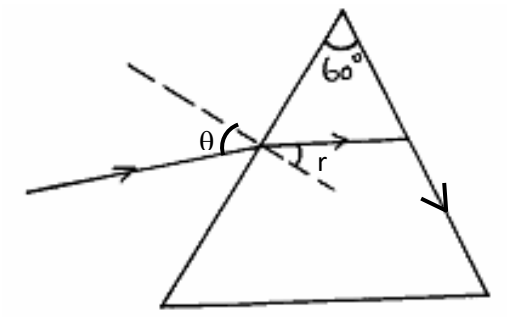
17. (a) State the meaning of the term critical angle as applied in refraction of light. (1 mark)
(b) The figure shows a ray of light incident on a glass-air interface.



(i) Show on the diagram the critical angle, **c**. (1 mark)
(ii) Given that the refractive index of the glass is ${}_a\eta_g$, and that the critical angle **c** = 42°, determine the value of is ${}_a\eta_g$. (3 marks)

18. Figure 7 below shows a narrow beam of white light onto a glass prism.

Figure 8



(i) What is the name of the phenomenon represented in the diagram? (1mk)
(ii) Name the colour at **X** and **Y**. Give a reason. (3mks)
(iii) What is the purpose of the slit? (1mk)

(b) Figure 8 below shows the path of ray of yellow light through a glass prism.The speed of yellow light in the prism is 1.8 x 10^8m/s.

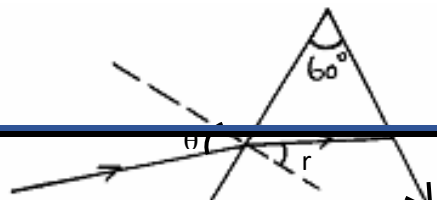


Figure 8

(i) Determine the refractive index of the prism material (speed of light in vacuum C = 3.0 x 10^8m/s). (3mks)

(ii) Show on the same diagram, the critical angle, c, and hence determine its value. (3mks)

(iii) Given that r = 31.2°, determine the angle θ. (3mks)

19. A ray of light incident on the surface of a glass prism is observed to behave as represented in figure 2 below.

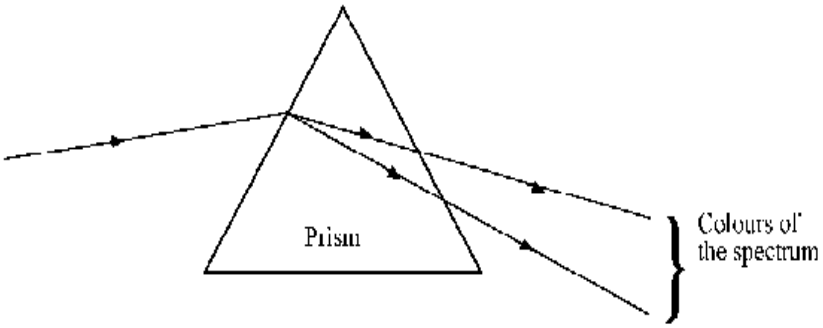


Figure 2

Explain this observation. (3mks)

20. Figure 3 shows a cross-section of an optical fibre made of two types of glass A and B. The refractive index of B is lower than that of A.

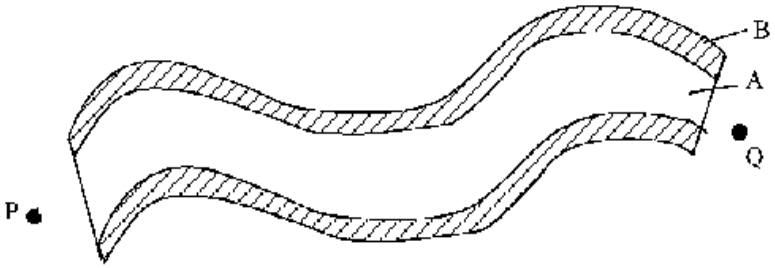


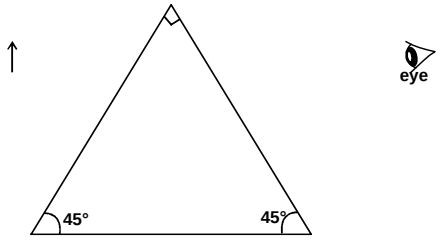
Figure 3

A ray of light enters the optical fibre at P and emerges from Q.

(i) Sketch the path of the ray through the fibre. (1mk)

(ii) State the reason why light travels through the fibre as in (i) above. (1mk)

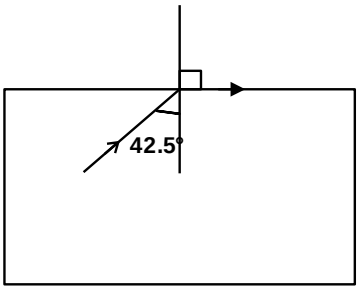
21. Figure 6 shows an object placed infront of a prism as shown.



Using two rays show the image of the object as observed by an observer at E.
(2 marks)

22. State the two conditions for total internal reflection in a triangular glass prism. (2 marks)

23. The figure below shows a path of a ray of light through a rectangular block of perspex placed in air.



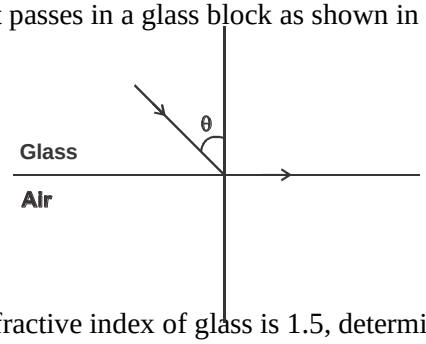
Calculate the refractive index of perspex. (2 marks)

24. A pin is placed at the bottom of the beaker of depth 14.5cm. The beaker is then filled with Kerosene. By using another pin on the side of the beaker and observing from the top, the distance of image of the pin in the beaker is found to be 4.5cm from the bottom.

Determine the refractive index of kerosene. (3 marks)

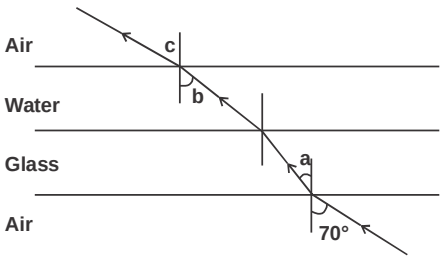
14. a) Define the term critical angle. (1 mark)

b) A ray of light passes in a glass block as shown in the figure 6 below.



Given that the refractive index of glass is 1.5, determine angle θ. (3 marks)

c) Figure 7 shows a ray of light travelling through successive media.

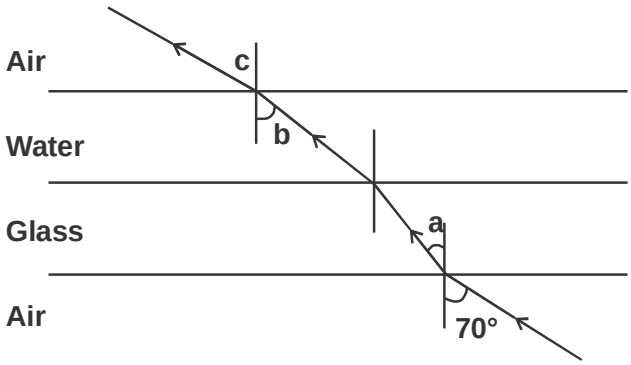


Given that the refractive index of glass is $^{3}/_{2}$ while that of water is $^{4}/_{3}$ determine :

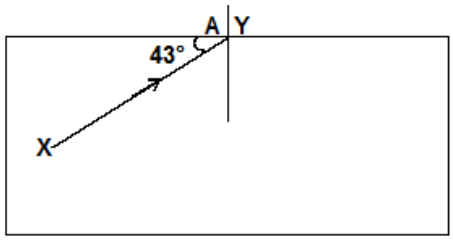
i)angle a (2 marks)

ii)angle b (2 marks)

iii)angle c (2 marks)

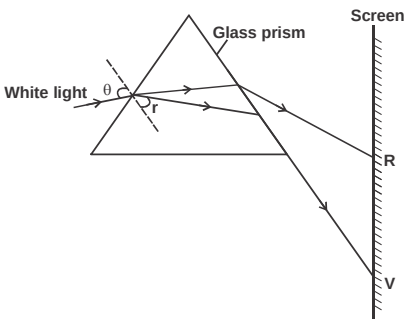


15. The diagram below shows a ray of light **xy** travelling through a glass block of critical angle 42° to pointA.



On the same diagram, draw the path of the ray as it travels past point **A**. (2 marks)

16. The figure below shows a ray of white light dispersed in a triangular prism. The speed of violet light in the prism is 1.88 x 10^8m/s.



a) Explain how glass disperses white light into read and violet bands. (1 mark)

b) Determine the refractive index of the prism material for violet light. (Take speed of violet light in vacuum = 3.0 x 10^8m/s)

(3 marks)

c) Show on the figure the critical angle, c, for violet light and determine its value. (3 marks)

d) Given that r = 21.5^o determine the angel □. (3 marks)

e) On the same figure, sketch the part of red light after white light strikes the prism if the prism was replaced by another of similar shape but lower refractive index. (use dotted line for the answer)(2 marks)

NAME	
ADMISSION NUMBER	

WORK, ENERGY, POWER AND MACHINES QUESTIONS

3. Figure 11 shows a load of 50N being raised by pulling it along an inclined plane of length 2.0m.

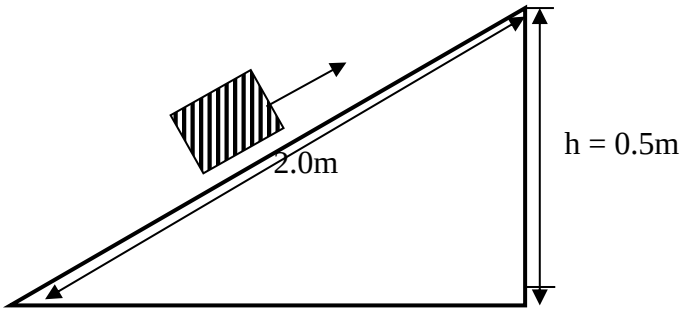


Figure 11

Determine

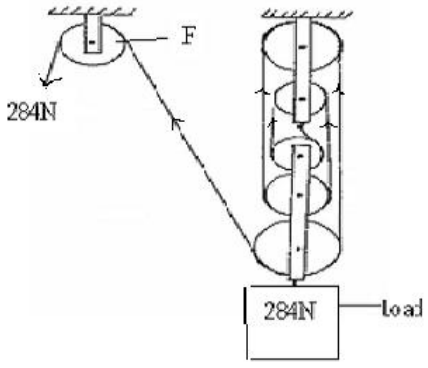
i. The work done by the 22N force (2 marks)

ii. The work done against the load (2 marks)

iii. The efficiency of the system (3 marks)

4. Apart from friction, name another factor that reduces efficiency in machines. (1 mark)

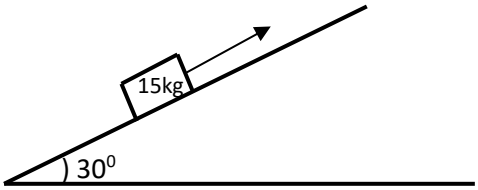
5. The figure **below** shows a machine being used to raise a load. Use the information given in the figure to answer questions **below**.



Determine the efficiency of the machine. (3 marks)

6. The figure below shows an inclined plane and a load of mass 15kg pulled by an effort of 100N.

100N



Find the efficiency of the machine (3marks)

7. (a) Sketch a block and tackle pulley with three movable pulleys in the lower block and two fixed pulleys in the upper block, to give a velocity ratio of 6. (3 marks)

Find:

(i) An effort of 450N is used to raise a load of 2700N. Determine:

- Mechanical advantage (M.A) (2 marks)
- Efficiency of the pulley system. (2 marks)

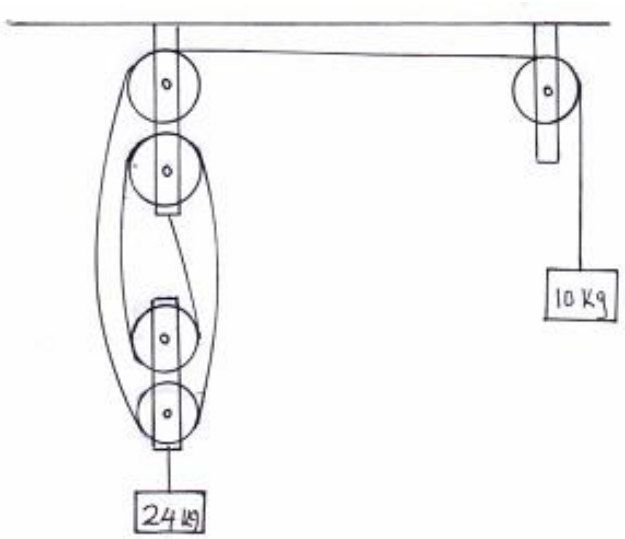
(ii) If all the wasted energy is used to raise the lower block and the frictional force between pulleys and moving parts is 3.6N; determine the weight of the lower block. (2 marks)

(c) If the load moved through a distance of 50cm, determine the useful work done by the effort. (3 marks)

(d) James applied a force of 400N in pushing a stationery wall. If he took one hour to push the wall, calculate the power developed. (1 mark)

8. (a) State **two** factors that affect the efficiency of a pulley system. (2mks)

(b) Figure 5 below shows a pulley system with the load rising at uniform speed.



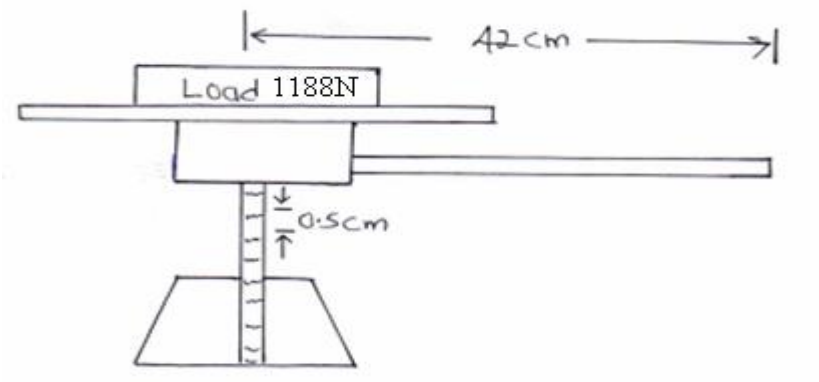
From the information given, calculate:

(i) The velocity ratio of the machine. (1mk)

(ii) Mechanical advantage of the machine. (2mks)

(iii) Efficiency of the machine. (3mks)

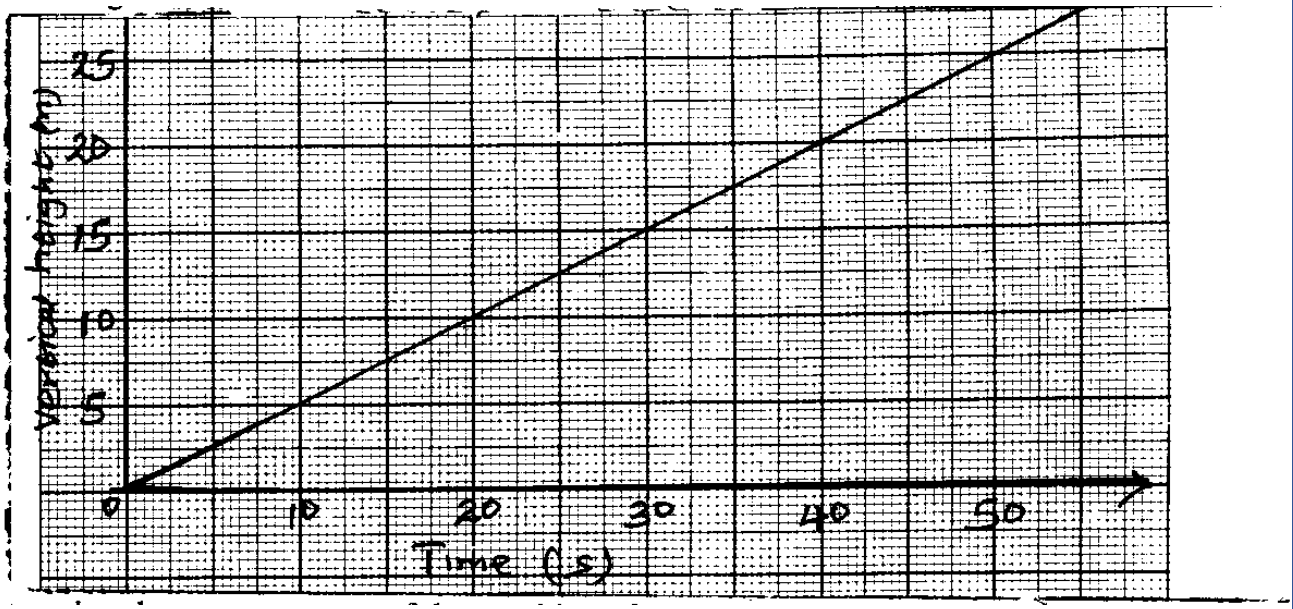
(c) The handle of the screw-jack in figure 6 below is 42cm long and the pitch of the screw is 0.5cm.



(i) Calculate the V.R of the screw jack. (2mks)
(ii) Calculate the effort needed to lift the load of 1188N. (2mks)

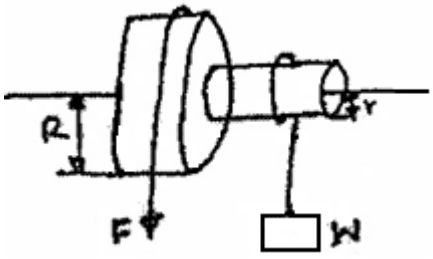
7. (a) Distinguish between load and effort. (2 marks)
(b) A mason uses a six wheel pulley system to raise a weight of 250N through a vertical height of 2.5m using the machine. If the mason pulls using an effort of 500N. Calculate:
i) The velocity ratio of the pulley system. (2 marks)
ii) The work done by the mason. (3 marks)
iii) The useful work done by the pulley system. (2 marks)
iv) The efficiency of the system (3marks)

8. Figure below shows a graph of how the vertical height through which a machine raises a mass 30kg varies with time.



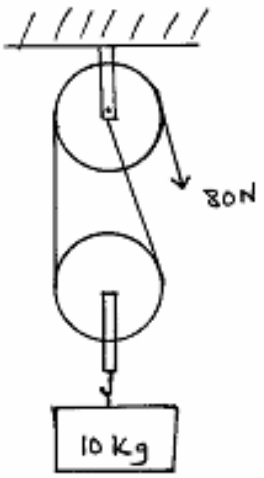
Determine the power output of the machine after 40 seconds. (3mks)

9. (a) Draw a single pulley arrangement with a velocity ratio of 2. (2mks)
(b) Figure shows a wheel and axle being used to raise a load W by applying an effort F. the radius of the large wheel is R and of the small wheel r as shown.



(i) Shows that the velocity ratio (V.R) of this machine is given by R/r. (3mks)
(ii) Given that r = 5cm, R = 8cm, determine effort required to raise a load of 20N if the efficiency of the machine is 80%. (4mks)
(iii) It is observed that the efficiency of the machines increases when it is used to lift large loads. Give a reason for this. (1mk)

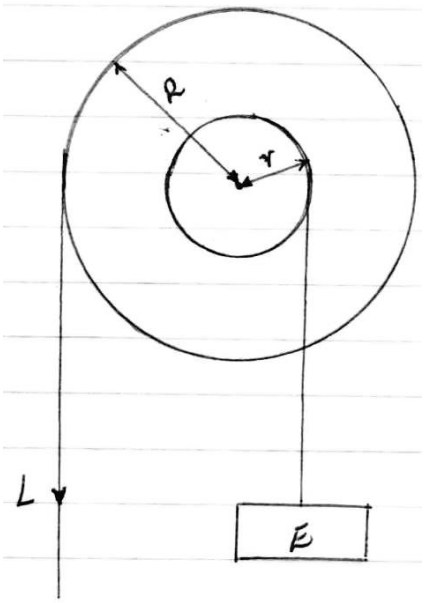
i. (a) Using the pulley system shown a mass of 10kg is raised 2M by effort of 80N.



(i) Calculate the distance the effort moves. (2mks)
(ii) How much potential energy does the load gain. (1mk)
(iii) How much work is done by the effort? (1mk)
(iv) What is the efficiency of these pulleys? (2mks)

(b) A small pump develops an average power of 100w it raises water from a borehole to a point 10M above the water level. Calculate the mass of water delivered in 30 minutes. (3mks)

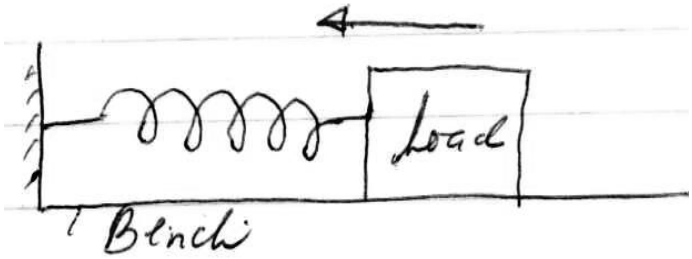
ii. Figure below shows a wheel and axle of radius R and r respectively.



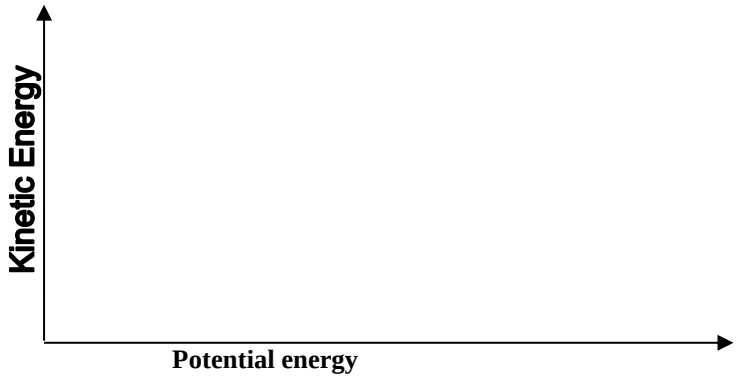
(a) Show that the velocity ratio of the system is given by $\left(\frac{R}{r}\right)$. (2mks)

(b) Given that r = 5cm, R = 20cm and an effort of 1200N is used to lift a load of 3000N. Determine:
The work done by effort to raise the load through a distance of 2m. (3mks)
The efficiency of the system. (3mks)
State **two** ways in which the efficiency in (ii) above can be increased. (2mks)

(c) A stretched spring with a load attached to one end and fixed at the other is released as shown below.



Sketch on the same axis below the graph of potential energy and kinetic energy with time(2mks)



iii. (a) In a car, the engine drives an alternator which produces electricity that lights the headlights. List the energy changes involved. (3 Mks)

(b) What is the power output of a pump which can raise 60kg of water to a height of 10m every minute. (3 Mks)

(c) If the efficiency of the pump in 11(b) is 80%, how much power must be supplied (2 Mks)

v. (a) The figures below shows a student of mass 60kg sliding freely down the slope AB. She continues and stops at point C.

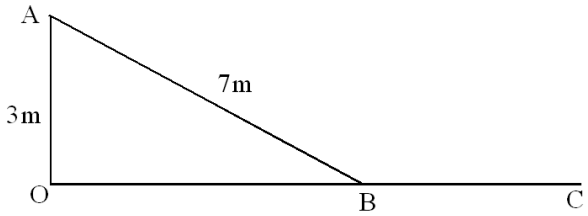


Fig. 8

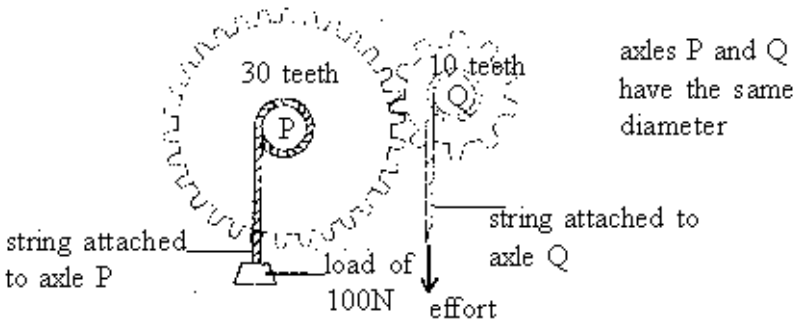
The frictional force is one-third of the students weight and acts uniformly all along the slide A to C. Take g = 10m/s^2.

(i) How much potential energy is lost by the student in sliding from A to B. (2mks)

(ii) Calculate the horizontal distance BC. (3mks)

(iii) Ignoring friction along AB and air resistance find the maximum velocity with which the student slides at any one point along the path. (2mks)

(b) The figure 9 shows a set of gears used to lift a load attached to the axle P by applying an effort to the axle.

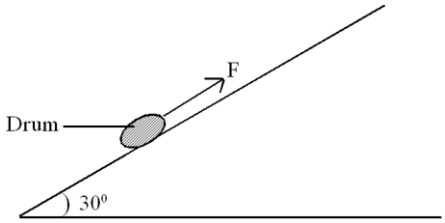


(i) In order to lift the load through a distance of 2m, the axle P must rotate 5 times. How many times must axle Q be rotated. (2mks)

(ii) Through what distance must the effort be applied of the axles P and Q have the same diameter. (2mks)

14. (a) Define the term efficiency of a machine. (1mk)

b) The figure below show a drum of mass 80kg being rolled up a plane inclined at 30^0 to the horizontal. The force applied is 420N and the distance moved by the drum along the plane is 5.0m.



Calculate :

(i) The work done by the effort (2mks)

(ii) the work done in rising the drum. (2mks)

(iii) the efficiency of the inclined plane as a machine. (2mks)

15. (a) Two gear-wheel have 80 teeth and 20 teeth and they lock with each other. They are fastened on axles of equal diameter such that equal weight of 150N attached to the string around the axle will just raise 450N on the other axles. Calculate

(i) The mechanical advantage. (2 marks)

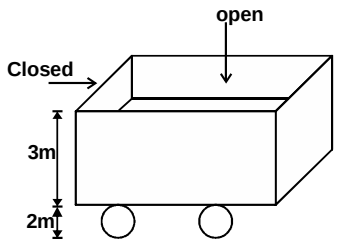
(ii) The velocity ratio. (2 marks)

(iii) The efficiency of the machine. (2 marks)

(b) (i) A loudspeaker is a transducer. Explain. (1 mark)

(ii) Explain the energy change that occur when a man climbs the mountain. (1 mark)

(c) Calculate the total power in lifting 0.2kg of metal cane containing $2000cm^3$ of ice onto a lorry as shown below within 4S. Density of ice is $0.9g/cm^3$ (3 marks)



16. (a) State the energy changes that occur when

(i) A man climbs a mountain. (1 mark)

(ii) A woman addresses a crowd using a microphone. (1 mark)

(b) A machine with a wheel of diameter 1.6m and axle of diameter 0.4m lifts a load of mass 12kg with an effort of 120N. Given that the acceleration due to gravity is $10m/s^2$.

Calculate

(i) The velocity ratio of the machine. (2 marks)

(ii) The mechanical advantage of the machine. (2 marks)

(iii) The efficiency of the machine. (2 marks)

(a) A bullet of mass 8×10^{-3} kg is fired horizontally into a block of wood of mass 0.6kg which it knocks and moves with an initial speed of 6m/s. Calculate

(i) The speed of the bullet. (2 marks)

(ii) The kinetic energy lost in the impact. (2 marks)