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1. Fig one shows a micrometer crew gauge being used to measure the diameter of a metal rod.
The thimble scale has 50 divisions

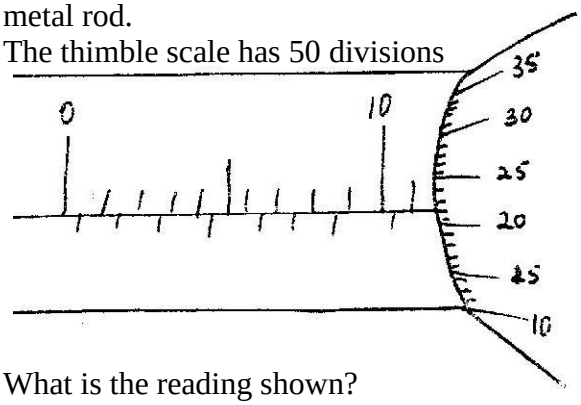


Fig. 1

What is the reading shown?

2. Fig. 2 represents a rock balanced at point O.G is the center of gravity of the rock. Use this information to answer questions 2 and 3.

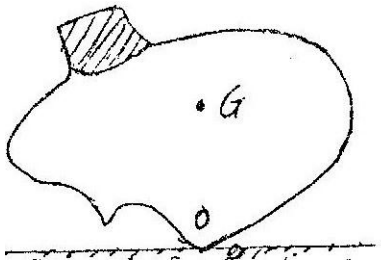


Fig. 2

Draw and label on the figure, the forces acting on the rock.

3. If the portion of the rock represented by the shaded part is chopped off explain why the rock may topple to the right.

4. A current of 0.70 A flows through a wire when a p.d of 0.35 V id applied at the ends of the wire. If the wire is 0.5m long and has a cross section area of 8.0 x 10-3 m-2, determine its resistivity.

5. The total weight of a car with passengers is 25,000N. The area of contact of each of the four tyres with the ground is 0.025m2. Determine the minimum car tyre pressure.

6. When an inflated balloon is placed at equal in a refrigerator it is noted that its volume reduces. Use the kinetic theory of gases to explain this observation.

7. An electric heater is placed at equal distances from two similar metal cans A and B filled with water at room temperature. The outer surface of can is shiny while that of can B is dull black. State with reasons which can will be at a higher temperature after the heater is switched on for some time.

8. Fig. 3 shows two rays of A and B entering a semi – circular glass block which has a critical angle of 42^{o}. The rays are incident at an air – glass boundary at point O.

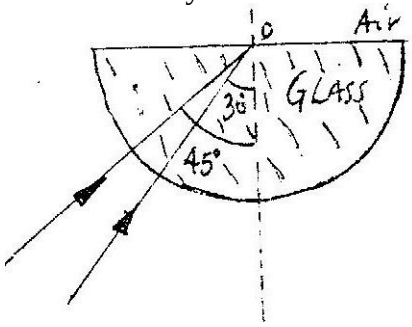


Fig. 3

Complete the path of the two rays from point O. label A' and B' the corresponding rays.

9. Fig. 4 shows electrical circuit. When the switch is closed the ammeter reading is 0.3 A.

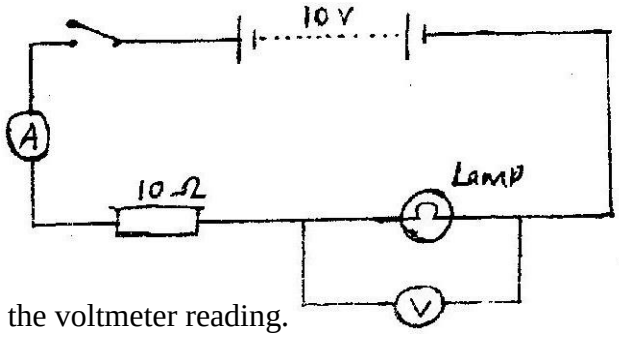


Fig. 4

Determine the voltmeter reading.

10. Fig. 5 shows a wire A and a spring B made of the same material. The thickness of the wire is the same in the both cases. Masses are added on each at the same intervals and the extension noted each time.

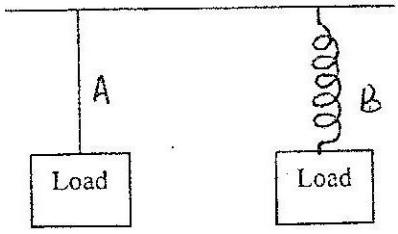
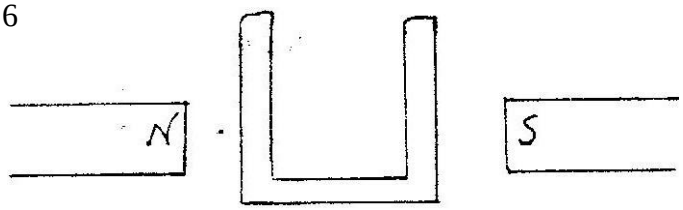


Fig. 5

On the same axes provided, sketch the graphs of extension against load for each. (hookers law is obeyed.)

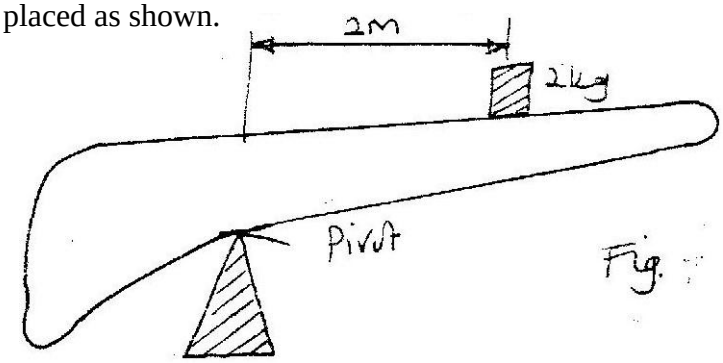
11. Fig. 6 shows a soft iron placed between poles of two magnets.

Figure 6



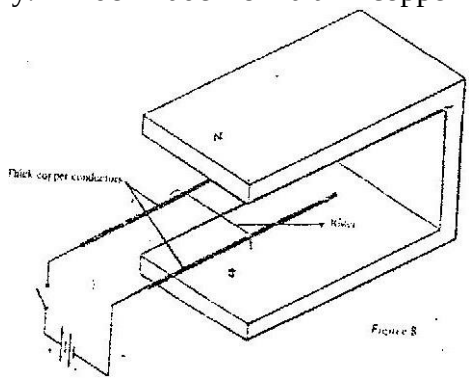
Sketch the magnetic field pattern.

12. Fig. 7 shows a non – uniform log of mass 100kg balanced on the pivot by a 2kg mass placed as shown.



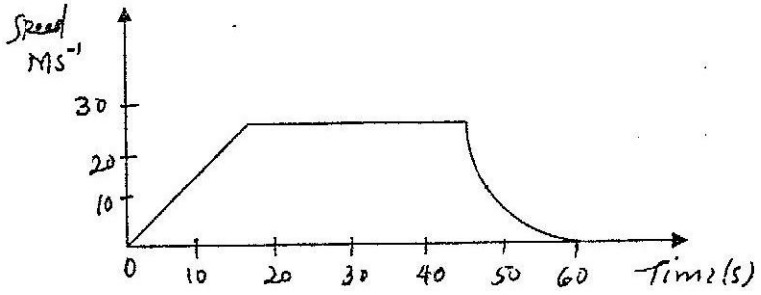
Determine the distance of the center of gravity of the log from the pivot.

13. Fig. 8 shows two parallel thick copper conductors connected to a D.C. power supply. A rider made from a thin copper wire is placed on the conductors.



State and explain what is observed on the rider when the switch is closed.

14. Fig. 9 shows a speed – time graph for the journey of a motorcar.



Determine the distance the car travels in the first 40 seconds.

15. Fig. 10 shows how the potential energy, (P.E) of a ball thrown vertically upwards, varies with height.

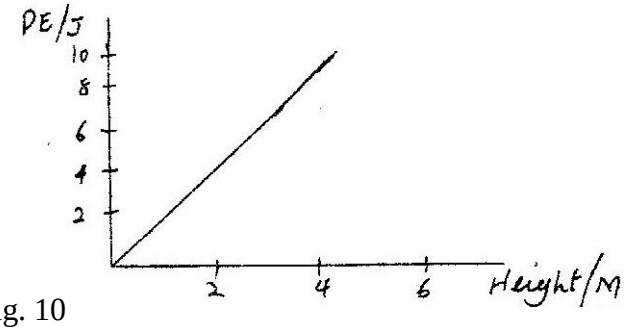


Fig. 10

On the same axes, plot a graph of the kinetic energy of the ball.

16. The chart below shows an arrangement of different parts of the electromagnetic spectrum.

RADIO	INFRARED	VISIBLE	A	X - RAYS	GAMMA RAYS

Name the radiation represented by A.

17. Name two factors other than tension, which determine the frequency of sound form stretched wire at room temperature.

18. An electric bulb with a filament of resistance 480Ω is connected to a 240V mains supply.
Determine the energy dissipated in 2 minutes (3mks).

19. An immersion heater rated 90W is placed is a liquid of mass 2kg. When the heater is switched on for 15 minutes the temperature of the liquid rises form 20^{o}C to 30^{o}C .Determine the specific heat capacity of the liquid. (Assume no heat losses)

20. A high jumper usually lands on thick soft mattress. Explain how the mattress helps in reducing the force of impact.

21. Fig. 11 shows part of the circuit containing tow capacitors of 2μF and 3μF respectively.

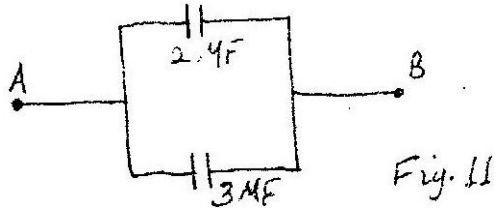


Fig. 11

Determine the p.d across AB given that the total charge in the capacitors is $1x10^{-4}$ Coulombs.

22. On the axes provided sketch the P-V graph for a gas obeying Boyle's law.

23. Fig. 12 shows water waves incident on an aperture AB.

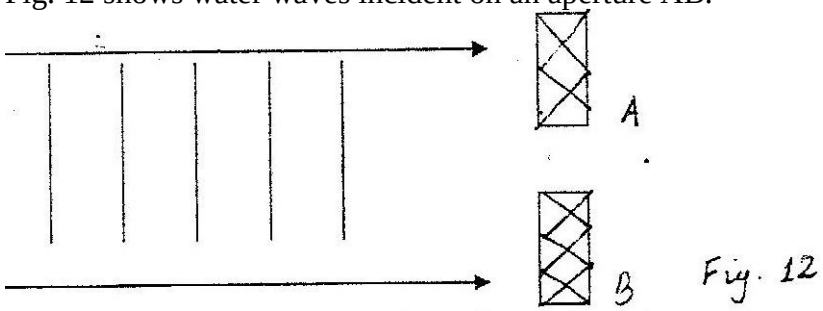


Fig. 12

On the same diagram, sketch the waves after going through the aperture.

24. The audible frequency range for a certain person is 30 Hz and 16,500 Hz. Determine the largest wavelength of sound in air the person can detect.(Speed of sound in air = 330m/s)

25. A block of glass of mass 250g floats in mercury. What volume of glass lies under the surface of the mercury? (Density of mercury is 13.6 x 103 kgm^{-3}).

26. A small object moving in a horizontal circle of radius 0.2m makes 8 revolutions per second.
Determine its centripetal acceleration.

27. Cobalt 60 is a radio isotope that has a half – life of 5.25 years. What fraction of the original atoms in a sample will remain after 21 years?

28. Fig. 13 represents an object O placed 10cm in front of a diverging lens is the focal point of the lens.

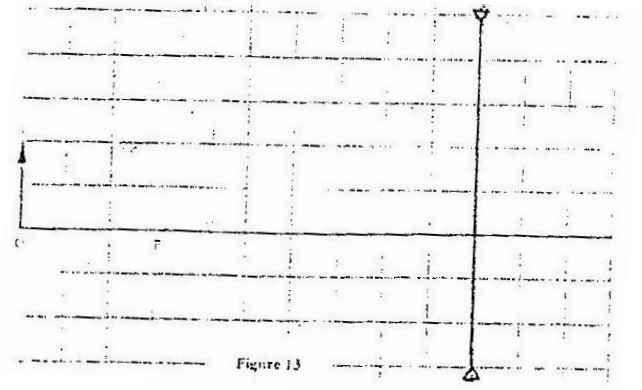


Figure 13

Draw rays to locate the position of the image. Determine the image distance.

29. The circuit figure 14 represents a simple radio receiver.

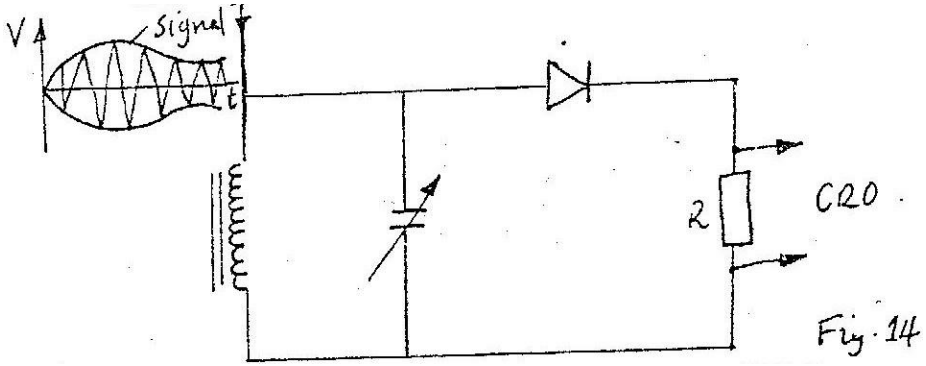


Fig. 14

On the axes provided, sketch the waveform observed on the CRO for the signal shown.

30. The following table shows electrical appliances to be used in a house. The electrical rating for each appliance is shown. The following fuses are available, 5A, 15A, 30A and 45A.

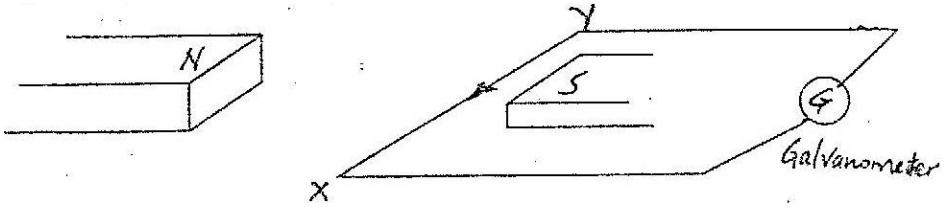
Appliances	Voltage (V)	Power (W)
T.V	250	300
Iron box	250	750
Electrical kettle	250	2,000

Determine which one of the fuses is suitable for the house.

31. A nucleus is represents by 10742x. State the number of neutrons in the nucleus.

32. State the property of X-rays, which makes it possible to detect cracks in bones.

33. Fig. 15 shows a wire XY placed in a magnetic field.



State the direction in which the wire must be moved for the current to move in the direction shown.

34. Light of a certain wavelength strikes the surface of a metal. State what determines the maximum kinetic energy of the electron emitted.

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1. Figure 1 shows the path of array of yellow light through a glass prism. The speed of yellow light in the prisms is 1.88×10^8m/s.

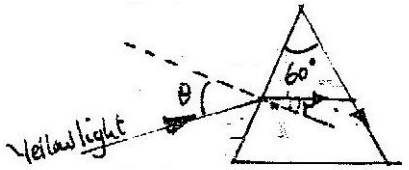


Fig 1

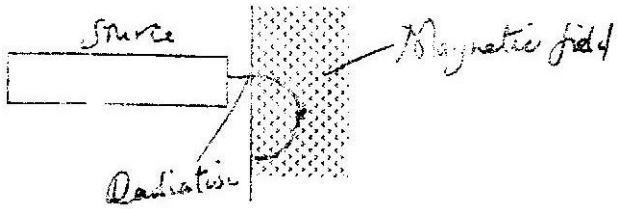
a) Determine the refractive index of the prism material for the light (speed of light in vacuum e = 3.0 x 108 ms^{-1})

b) Show on the figure the critical angle, c, and determine its value.

c) Given that r = 21.2°, determine the angle θ

d) On the same figure, sketch the path of the light after striking the prism if the prism was replaced by another of similar shape but lower refractive index. (Use dotted line for your answer)

2. Fig. 3. Shows the path of radiation form a radioactive source after entering a magnetic field. The magnetic field is directed into the paper and is perpendicular to the plane of the paper as shown in the figure.



Identify the radiation

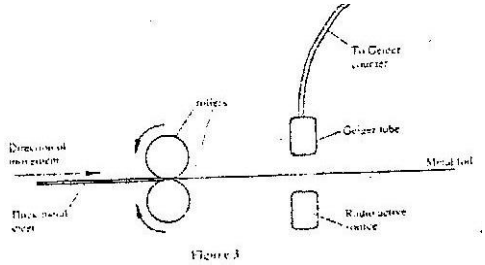
b) Below is a nuclear reaction

$$^{232}_{90}A \xrightarrow{K} ^{228}_{88}X \xrightarrow{} ^{}Y$$

i) Identify radiation K

ii) Determine the values of X and Y.

(c) Fig 3 shows a device for producing metal foils of constant thickness. Any change in thickness can be detected by the Geiger tube and recorded by the Geiger. The pressure adjusted by the roller is then adjusted to keep the thickness constant.



(i) State the change in the metal foil that will lead to a decrease in the Geiger counter reading

(ii) Give a reason for your answer in c(i) above

(iii) State the change in the roller pressure that should be made as a result of this decrease in the Geiger counter reading.
(iv) Give a reason for your in (c) (iii) above
(v) Explain why a source emitting □(alpha) particles only would not be suitable for this device.
(vi) Explain why a radioactive source of a half-life of 1600 years is more suitable for use in the device than one of a half-life of 8 minutes.

3. Fig. 4 shows a block of a mass 30.0 kg being pulled up a slope by a force P at a constant speed. The friction force on the block is 20.0N.

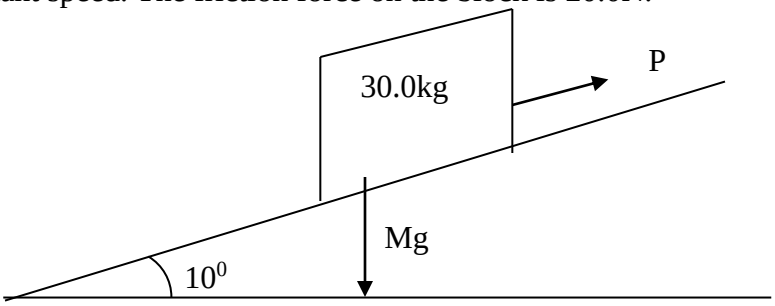


Fig. 4

a i) On the same figure name and indicate the other forces acting on the block.
ii) Determine the component of the weight acting on the trolley down the slope
iii) Determine the value of P.

b) On reaching the top of the slope, the block is left to run freely down the slope.
i) Which one of the forces previously acting on the block would then act in the opposite?
ii) Determine the acceleration of the block down the slope.
iii) What is the effect of increasing the angle of slope on your answer in (ii) above.

4. a) Fig 5. Shows the variation of temperature, T (^{0}C), with time, t (seconds). When frozen water is heated for sometime.

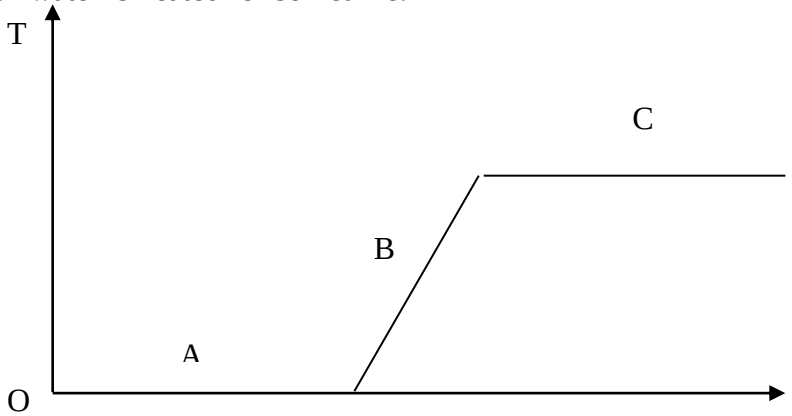


Fig. 5

(i) Explain the shape of the curve at the parts labeled AB and C.
A B C

(ii) It is observed that when the temperature starts to rise, the volume initially decreases and then increases. State the reason for this observation.

(iii) In the fig. 5 sketch and explain the curve that would be obtained if frozen water was used. (Hint: specific heat capacity for seawater is lower what of fresh water.

(b) Determine the quantity of heat energy required to change 3.0 kg of ice at 0^0 C to water at 5 ^{0}C. Specific latent heat of fusion of ice is 3.36 x 10^5 J/kg. Specific heat capacity of water is 4200J/kgK)

5 a) Fig 6.1 shows the cross- section of a ripple tank full of water. A piece of cork floats on the surface of the water as shown. Fig 6 II shows the water surface viewed from above. A straight edge vibrator placed at the end A of ripple tank generates water waves, which travel towards end B as shown.

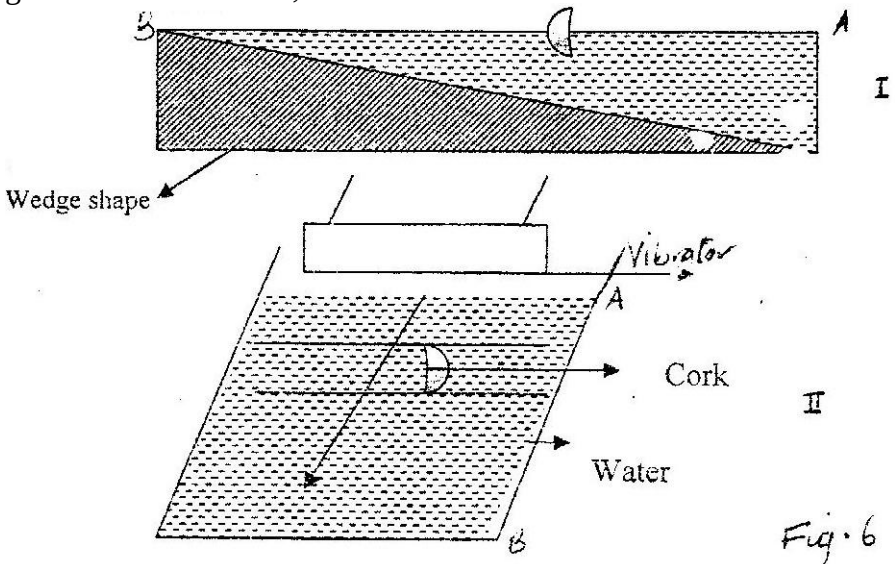


Fig. 6

(i) Identify the type of waves generated on the water surface.

(ii) It is observed that as the waves pass the cork, there is no net movement on the cork. Explain this observation

(iii) A student estimates that successive waves pass the cork every 0.20 seconds. If the speed of the waves is 0.30 ms^{-1} , determine the frequency and wavelength of the waves at that point.

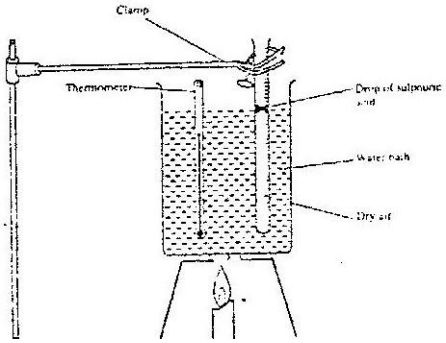
iv) In the space provided, sketch the wave fronts as viewed from a point above the ripple tank.

v) Explain the answer in part (iv) above

b) A tuning fork is sounded at the mouth of a pipe whose one end is closed with a moveable piston. Resonance is observed successively when the piston is 77cm and then at 129 cm. If the speed of sound in air is 340ms $^{-1}$, determine the frequency of the tuning fork.

6. a) State the law that relates the volume of a gas to the temperature of a gas.

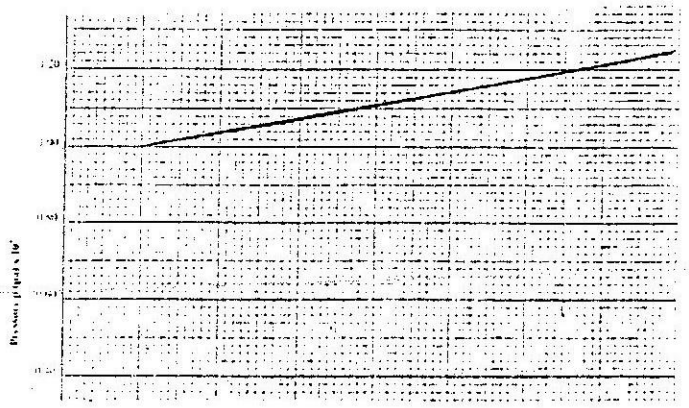
b) Fig 7. shows an experiment set-up that may be used to investigate one of the laws. The glass tube has a uniform bore and it is graduated in millimeters



i) Describe how the experiment was carried out and explain how the results obtained verify the law.

ii) Limitations of the set up are?

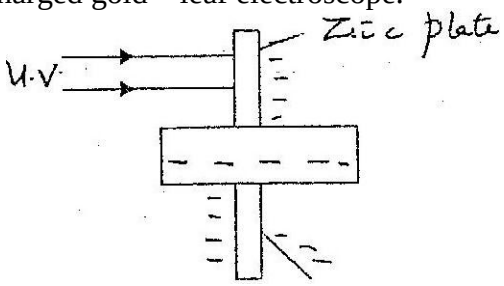
c) In an experiment to find the relation between pressure, p, and temperature, θ, of a gas at a constant volume, values of temperature were determined. The results obtained are shown in the graph below.



(i) From the graph, determine the pressure at a temperature of 273K.

(ii) Assuming the relation $p/T_0+\theta$ = constant holds for this graph determine the value of the constant T_0

7a) Fig. 8 shows ultra violet light striking a polished zinc plate placed on a negatively charged gold – leaf electroscope.



Explain the following observations

i) The leaf of the electroscope falls.

ii) When the same experiment was repeated with a positively charged electroscope the leaf did not fall.

bi) State two factors which determine the speed of photoelectrons emitted by a metal surface

ii) In an experiment using a photocell, u, v. light of varying frequency but constant intensity was made to strike a metal surface. The maximum kinetic energy ($K.E_{max}$) of photoelectrons for each frequency, was measured. The graph shows how KE_{max} varies with f.

Given that KE max = hf - Φ , determine the value of the constants h and φ form the graph.

c) Light of frequency 5.5 x 1014 Hz is made to strike a surface whose work function is 2.5eV.

Show that photoelectric effect will not take place.(Use the value of h from (b) above.