PHYSICS PAPER II 2004 QUESTIONS
SECTION 1 (65 MKS)

1. a) A test tube of uniform cross-section loaded so that it can float upright in water. With the aid of a labeled diagram, describe how the test tube may be calibrated to measure the density of liquid.

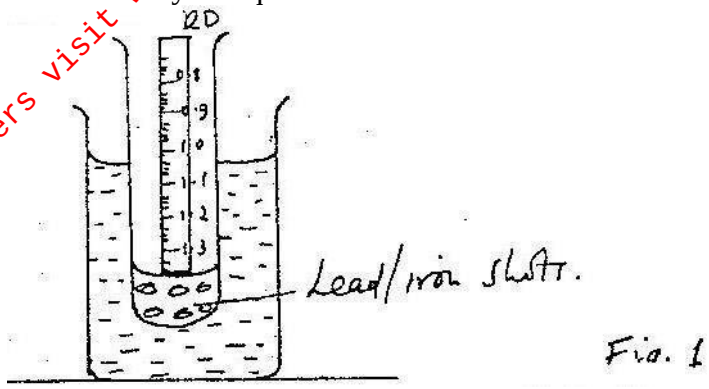
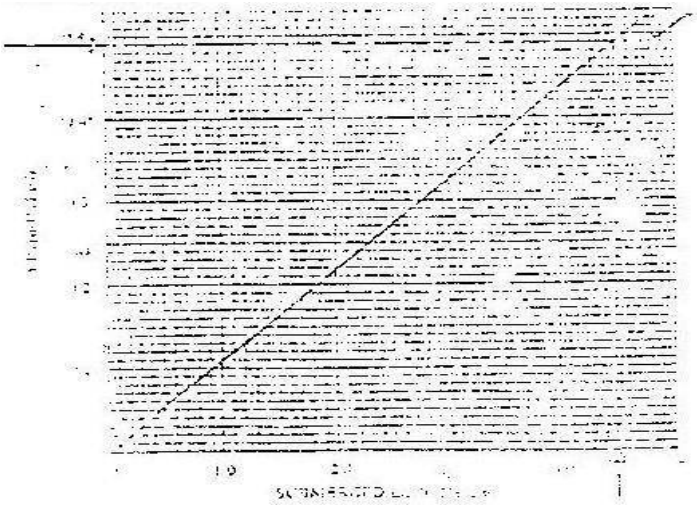


Fig. 1

b) In an experiment to determine the density of a liquid, a uniform metal cylinder of cross-section area 6.2cm was hang from a spring balance and lowered gradually into the liquid. The up thrust was determined for various submerged lengths. The results obtained are shown on the graph in Fig 1.



Using graph, determine;

(i) The value of the up thrust when the cylinder is fully submerged

(ii) The Density of the liquid

2. a) In an experiment to determine the power of an electric heater, melting ice was place in a container with an outlet and the heater placed in the ice as shown in Fig. 2. The melted ice was collected.

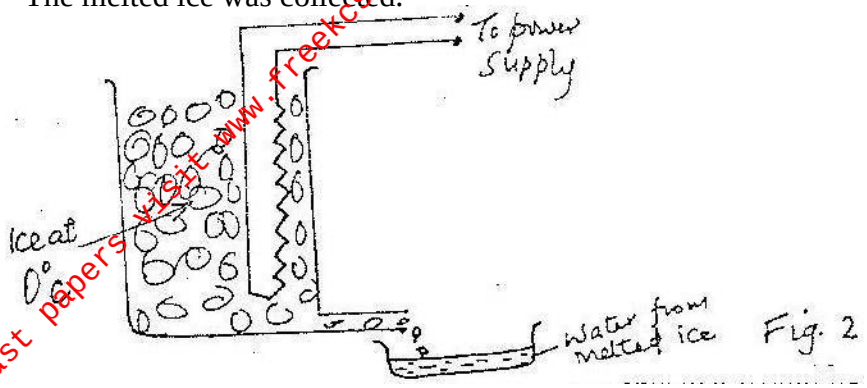


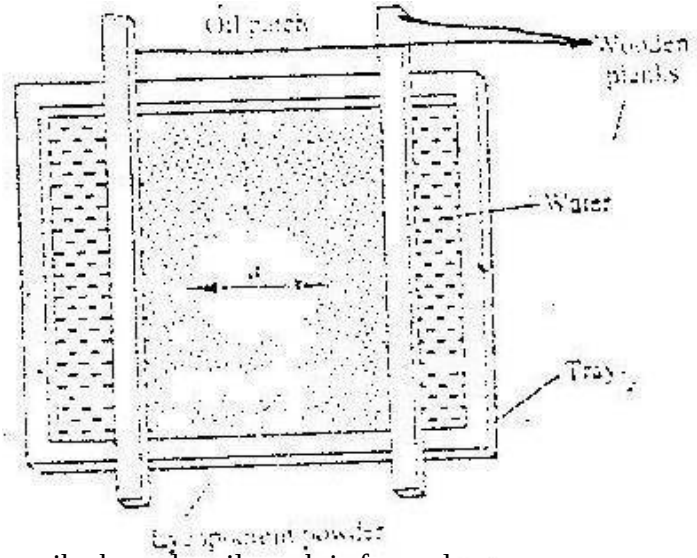
Fig. 2

i) Other than the current and voltage, state the measurement that would be taken to determine the quantity of heat absorbed by the melted ice in unit time.

(ii) If the latent heat of fusion of ice is L, show how measurement in (i) above would be used in determining the power P. of the heater.

(iii) It is found that the power determined in this experiment is lower than the manufacturer's value indicated on the heater.

b) Fig 3 shows part of an experimental set up for estimating the diameter of an oil molecule.



i) Describe how the oil patch is formed

ii) In an experiment the diameter a, of the patch was measured to be 200mm for an oil drop of radius 0.25mm. Determine the diameter of the molecule of the oil.

3. Figure 4 shows the cross-section of a diffusion cloud chamber used to detect radiation from radioactive sources.

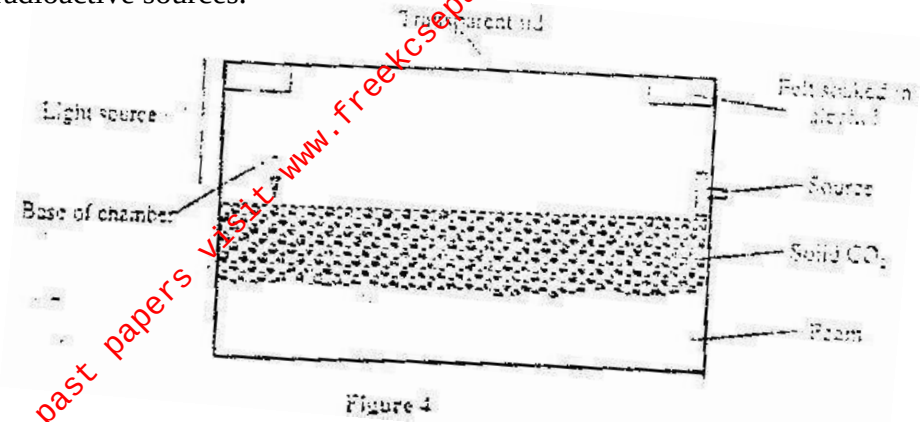


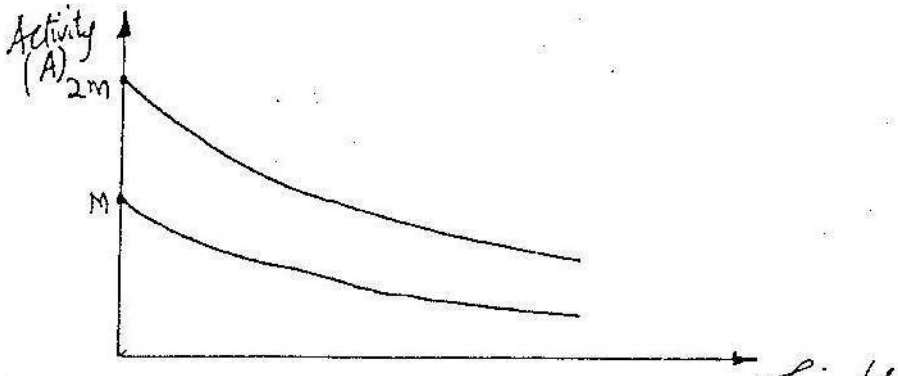
Figure 4

a) i) State one function of each of the following:
Alcohol
solid C_{o2}

ii) When radiation from the source enters the chamber, some white traces are observed. Explain how these traces are formed and state how the radiation is identified.

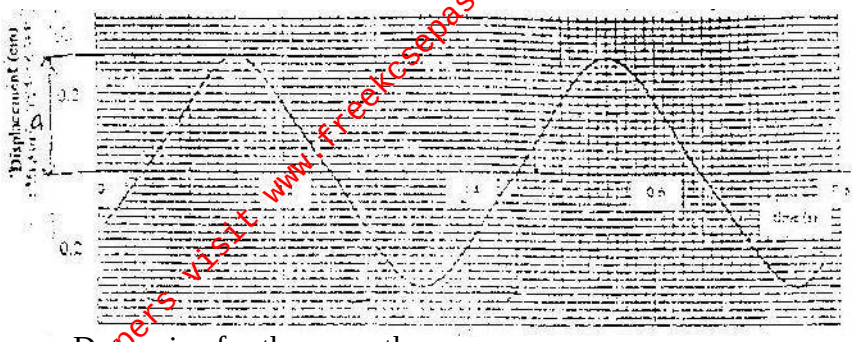
iii) A leaf electroscope can also be used as a detector of radiation. State two advantages of the diffusion cloud chamber over the leaf electroscope as a detector.

b) i) Two samples of the same radioactive material have initial masses M and 2M respectively. On the axes provided, sketch the graph of activity versus time for each sample. Label the graph for each sample.



ii) A radioactive sample of half-life 130 days initially has 1.0×10^{2c} radioactive atoms. Determine the number of radioactive atoms that have decayed after 390 days.

a) Fig 5 shows the displacement time graph of a wave traveling at 200cm/s



Determine for the wave the

i) Amplitude
ii) Period
iii) Frequency
iv) Wavelength

b) i) In the space provided below, sketch a labeled diagram to show how pinhole camera forms an image of a vertical object placed in front of the pinhole.

ii) a building standing 200m from a pinhole camera produces on the screen of the camera an image 2.5cm high 5.0cm behind the pinhole. Determine the actual height of the building.

5. a) Fig 6 shows a simple generator. The coils are rotated in the anticlockwise direction as shown.

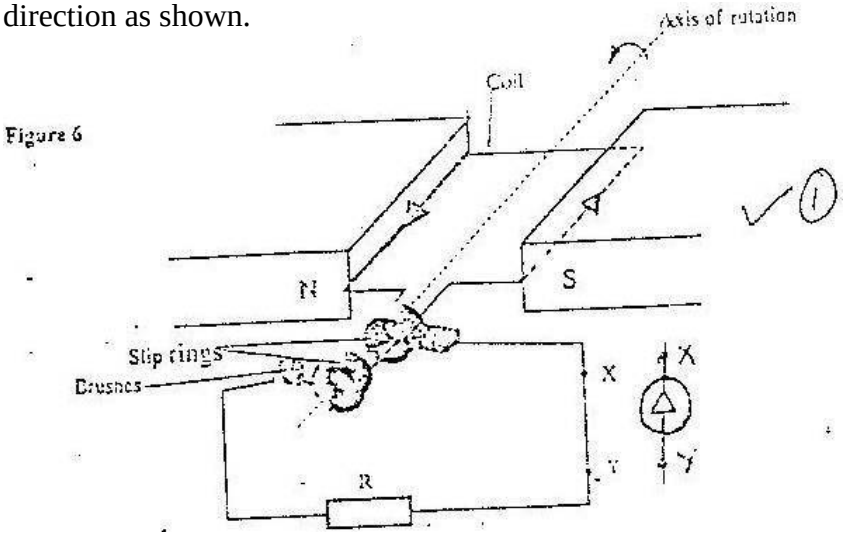


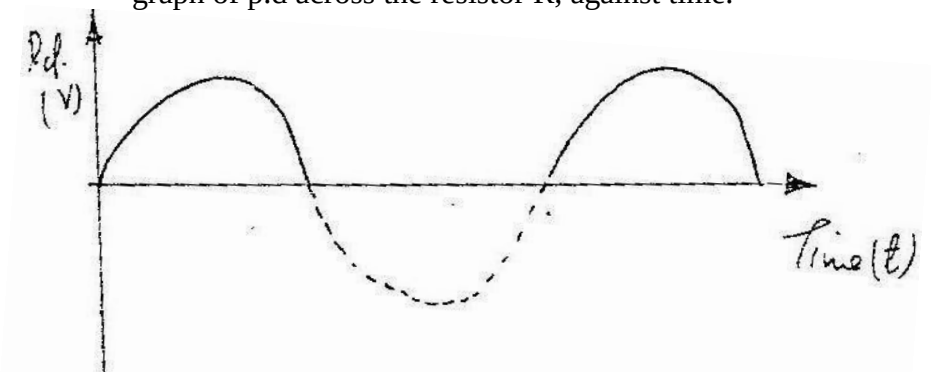
Figure 6

i) Indicate using an arrow on the figure, the direction of the induced current as the coil passes the position shown.

ii State two ways of increasing the magnitude of the induced current in this type of generator.

iii) On the axes provided, sketch the graph of the induced e.m.f with time.

iv) The section marked XY is cut off and a diode inserted. On the axes provided, sketch the graph of p.d across the resistor R, against time.



b) Fig 7 shows pendulum A and pendulum B freely suspended between the poles of identical magnets. Pendulum a is made of thick copper plate while B is made a copper plate with slots

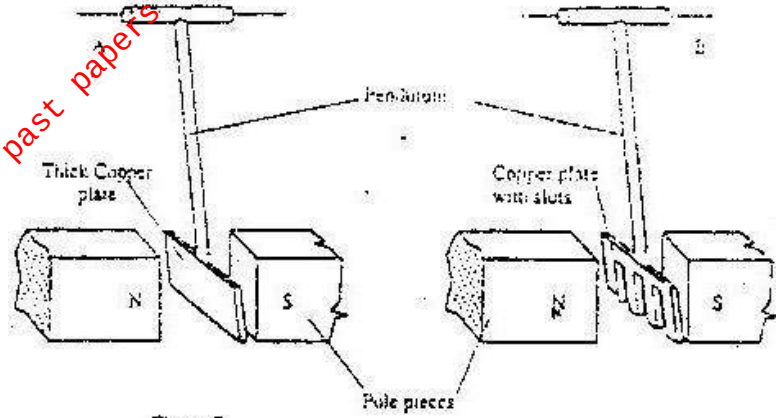


Figure 7

When the two are set to swing, it is observed that A slows down faster then B Explain this observation.

c) An alternating current source has a root-mean-square potential difference of 12,V, Determine the peak value of this potential difference.

SECTION II (15MKS)

Answer ONE question from this section on the spaces provided at the end of question seven.

6. a) You are provided with two identical tuning forks and some plasticine.
Describe how you would demonstrate beats in sound.

b) Fig 8 shows a set up that was used in an experiment to determine the speed of sound air

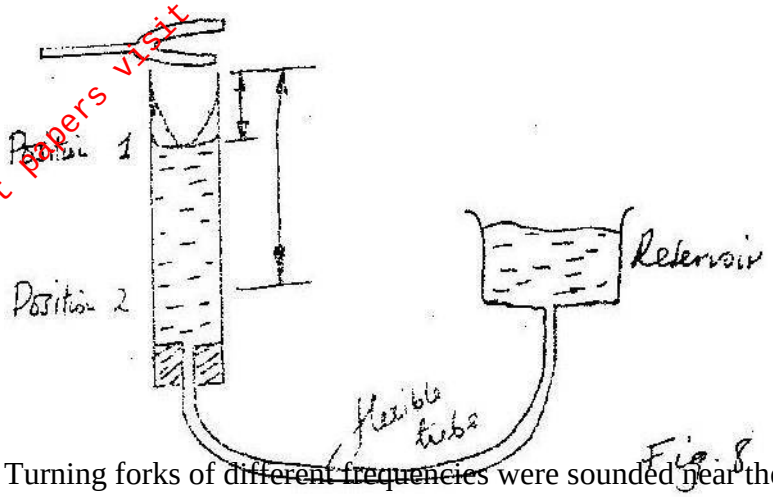


Fig. 8

Turning forks of different frequencies were sounded near the mouth of the open tube and by lowering the reservoir, the list two resonant lengthsL_1 L_2 were ensured for each frequency.
Table 1 shows the results obtained.

Frequency, f (HZ)	256	288	341	427	480	512
L_1(cm)	30,8	27.2	22.8	17.9	15.8	14.7
L_2(cm)	95.5	84.5	71.2	56.6	50.2	46.9
$^1/_f$ (HZ^{-1})						
$L_2 - l_{1(m)}$						

(i) Complete the table. On the grid provided, plot the graph of $l_2 - l_1$ (y-axis) against $^1/_f$

(ii) From the graph determine the speed V of sound in air given that
1_2-1_1 = v/2r. Therefore V= $2f(1_2 - 1_1)$

(iii) Explain how resonance is attained in this set up.

7. a) i) What is photoelectric effect?

ii) You are provided with the following:
a photocell, a source uv light, a rheostat, a source of e.m.f, a milliammeter, a voltmeter and connecting wires. Draw a circuit diagram to show how photoelectric effect may be demonstrated in the laboratory.

b) In a photoelectric effect experiment, a certain surface was illuminated with radiation of different frequencies and the stopping potential determined for each frequency.

Table 2 shows the results obtained.
Table 2.

Frequency, f ($x10^{14}$ HZ)	7.95	7.41	6.88	6.10	5.49
Stopping Potential, V_s (V)	1.35	1.15	0.93	0.62	0.36

(i) Plot the graph of the graph of stopping potential (y-axis) against frequency.

(ii) Determine Planks Constant, h, and the work function, θ,of the surface given that

$eV_s = hf - hf_o$

where e= 1.6×10^{-19} coulomb and hf = θ
f_o is the lowest frequency that can cause photoelectric effect.

c) A surface whose work functionθ = 6.4×10^{-19} joules is illuminated with light of frequency $3.0 \times 10\ 15H_Z$

Find the maximum Kinetic energy of the emitted photoelectrons (Use the Value of H obtained in b(ii)