YEAR 2011 PAPER 2 2 NOVEMBER 2011,
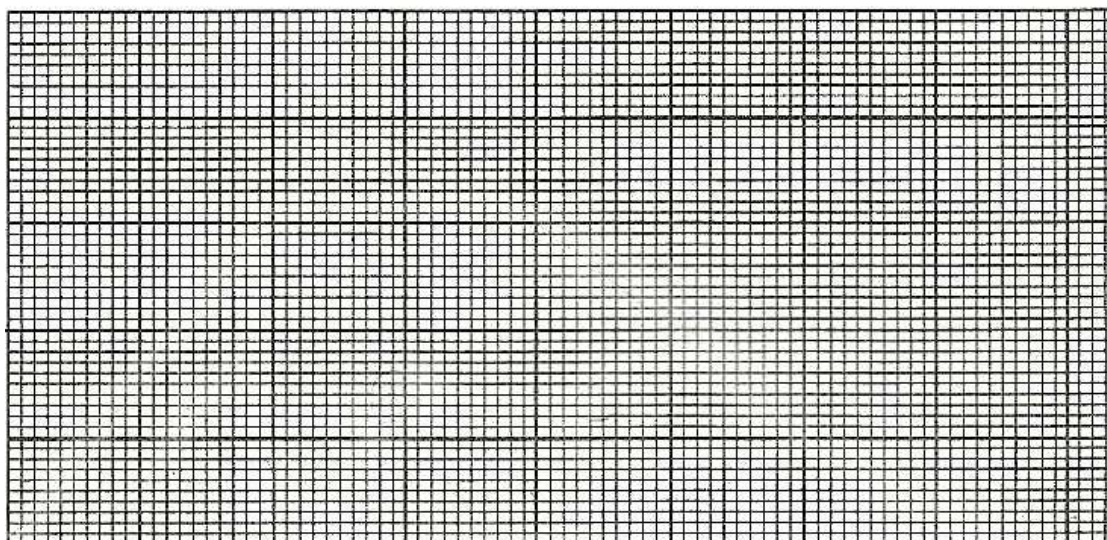
<p align="center">

Section A

[45 marks]

Answer all questions.

Write your answers in the spaces provided on the question paper.

</p>

1. A cyclist accelerates uniformly from rest to a velocity of 10m/s in 3s. He then moves with a constant velocity of 10m/s for 6s, before decelerating uniformly to rest in a further 5s.

(a)   Draw a velocity-time graph representing the cyclist's motion.

 (b) Calculate the distance travelled by the cyclist during the journey.

Distance = |0   [2]

<p align="center">**Total: [5]**</p>

2.   (a) What is meant by the centre of mass of an object?

(b)   Explain why a minibus is more likely to topple over when the roof rack is heavily loaded than when the roof rack is empty.

(c)   A metre rule is supported on a knife-edge placed at the 40cm mark. !t is found that the metre rule balances when a mass of 45g is suspended from the 15cm mark as shown in **Figure 2.1.**
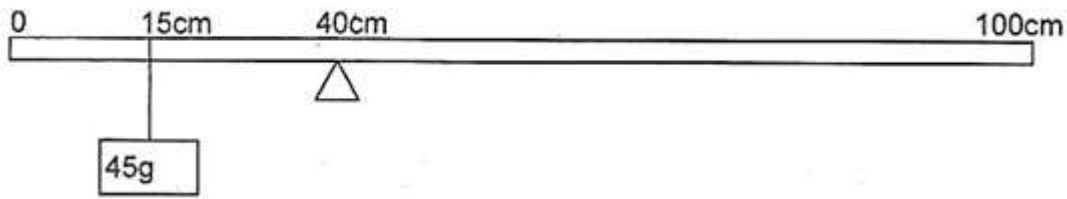
If the centre of mass of the metre rule is at the 52.5cm mark, calculate the mass of the metre rule.

Mass =

3. A girl whose mass is 45kg carries a box of mass 25kg up a flight of steps. There are 40 steps each 40cm high. She takes 16s to climb up the steps. (Take $g = 10m/s^2$)

   a. What is her weight?

   b. What is the weight of the box?

   c. Calculate the total gravitational potential energy of the girl and the box when she reaches the top.

Gravitational potential energy =

   d. Calculate the total power.

4. (a) The diagram below represents a bar of soft iron which is to be magnetised with a north pole at end
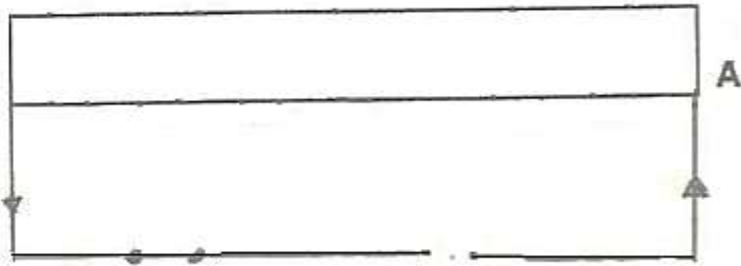
Complete the diagram to show how you would arrange a coil connected to a cell to achieve this. Make clear on your diagram the windings of the coil and the polarity of each cell terminal.

   (b) What would be the effect of disconnecting the cell on the magnetisation of the bar?

5. (a) The pressure of air in a tyre of an empty lorry is 3.0×10^5Pa and the volume of the air in the tyre is $0.080m^3$. Calculate the volume of the air in the tyre when the lorry is loaded until the pressure of the air in the tyre rises to 3.6×10^5Pa. (Assume that the air temperature is constant).

   (b) The tyre pressure of a lorry that has been moving for some time is usually greater than the pressure when the lorry has been standing at rest. Why is this so?

6. Two successive crests of an approaching water wave are separated by a distance of 1,5m. It takes 0.2s for one crest to cover the distance of 1.5m.

a. At what speed is the wave travelling?

b. What is the frequency of the wave?

c. Distinguish between the nature of water wave and a sound wave.

   i. Water wave is ….

   ii. Sound wave is …

7. A 4cm high object is placed 8cm from a convex lens of focal length 3cm. Draw a scale diagram to find the position and size of the image.

[2]
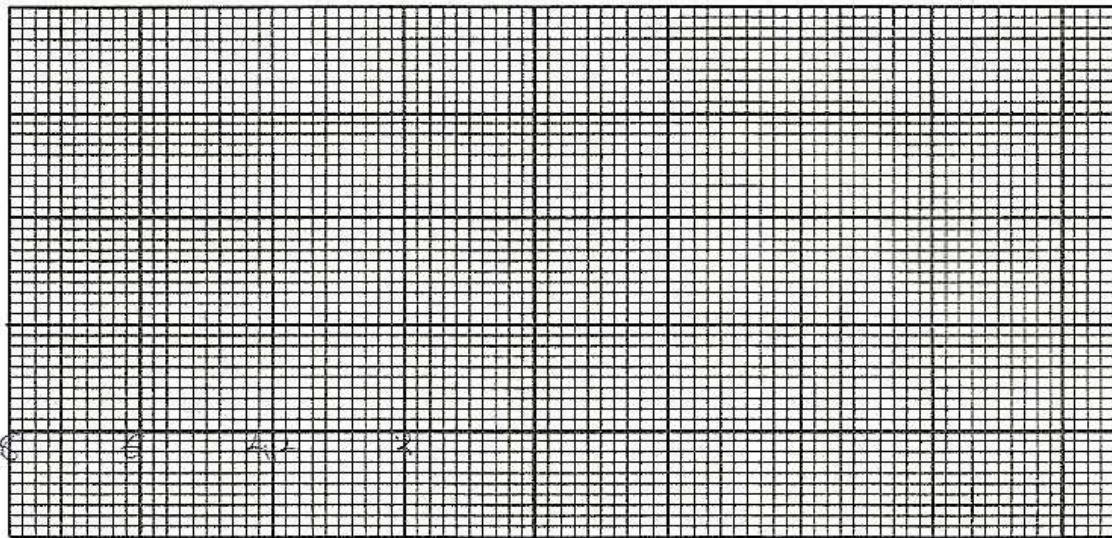
a) Position of the image

b)) Size of the image

8. **Figure 8.1** shows a diagram of a clinical thermometer with some features labelled.
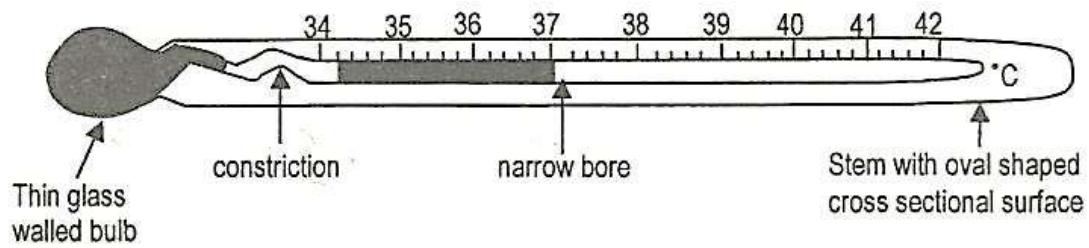
Figure 8.1

Explain why it has each of the following features:

(a) A thin glass walled bulb,

(b) A constriction

(c) A short range of temperature calibration,

(d) A narrow bore,

(e) An oval shaped glass stem.

9. **Figure 9.1** shows two metal spheres **A** and B being charged by induction using a negatively charged rod brought near **A.** In **figure 9.2,** the two spheres are separated. In **figure 9.3,** the charged rod is removed.


Figure 9.1   Figure 9.2   Figure 9.3
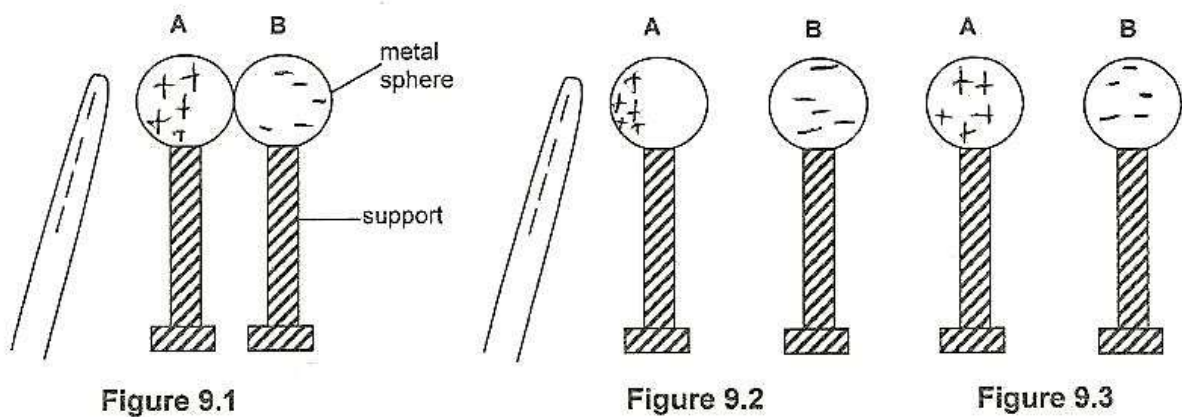
a. What should be the nature of material used as the support of each sphere?

b. On each sphere in **9.1, 9.2** and **9.3,** indicate the charge distribution.

[20 marks]

*Answer any **two (2)** questions from this section. Use the **Answer Booklet** provided.*

10. (a) Define density of a substance

    (b) Describe an experiment you would perform to determine the density of an irregularly shaped object such as a stone.

    (c) An empty tin of mass 20g and capacity 25cm^3 was used to measure the density of mercury. When full of mercury, the mass of the tin and mercury was 360g. What is the density of mercury?

11. Radioactive isotopes can be used to locate internal bleeding in the body. A commonly used radioactive isotope is iodine - 131 (^{131}l). This emits gamma radiation and has a half-life of 8 days.

    a. Describe what is meant by a radioactive isotope.

    b. Describe what is meant by half-life.

    c. The activity of a sample of iodine - 131 (^{131}l) was measured over a period of 20 minutes on three separate occasions. The readings obtained were:- 338Bq, 326Bq, 356Bq.

        i.   Explain why the readings were not all the same.

        ii. Calculate the average count rate for the radioactive isotope.

 (d) A patient has internal bleeding from a blood vessel in her leg. A small quantity of the isotope ^{131}1 is injected into her blood stream. A detector is used to find the internal bleeding. **Figure 11.1** shows the arrangement and the results of the test.
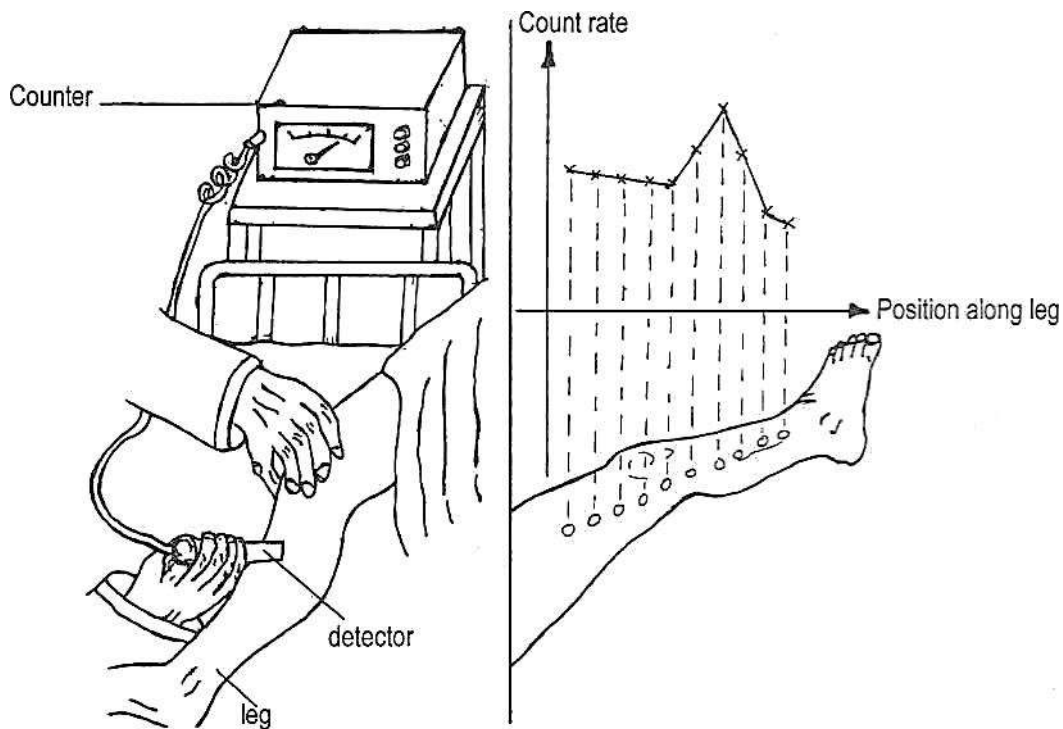
Figure 11.1

    i.   State the name of a suitable detector.   [1]

    ii.   The radioactive isotope used for this purpose is a gamma emitter and not an alpha emitter. Why is a gamma emitter used?   [2]

    iii.   How will the doctor tell from the results where the internal bleeding is taking place?

12. Figure 12.1 shows a bucket with a heating element at the bottom. The bucket has a plastic body with the outside casing of the element which is a metal.
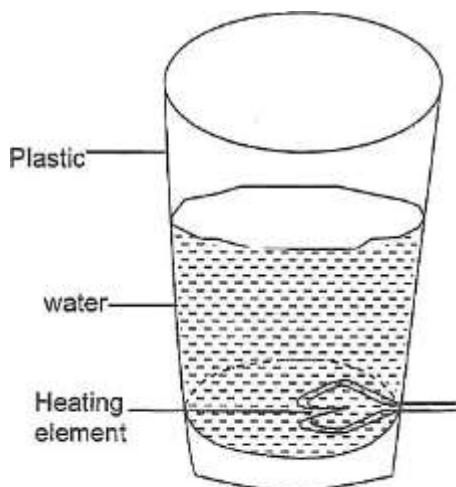
Figure 12.1

    a. Explain why;

i.   a fuse is included in the circuit and what happens when the fuse blows.   [2]

ii.   the metal casing of the heating element is connected to the earth.   [2]

b. The electrical power input to the bucket is 2000W and the bucket is switched on for 6 minutes. Calculate the electrical energy, in Joules supplied to the bucket.   [3]

c. Explain, in molecular terms, how evaporation causes loss of energy from the water when the element is switched off.   [3]

Total: [10]