

(i) Describe how the oil patch is formed. (2 marks)

(ii) In an experiment, the diameter,  $a$ , of the patch was measured to be 200 mm for an oil drop of radius 0.25 mm. Determine the diameter of the molecule of the oil. (4 marks)

State why this is an estimate. (1 mark)

(iii) Describe one method of determining the diameter of the oil drop. (3 marks)

This is a popular experiment in this topic in which the diameter of an oil molecule is roughly determined. Candidates were expected to recall the oil patch forms when molecules of oil spread until they form a single layer of one 'molecule height'. This is the basis upon which further calculations depend. Teachers should demonstrate this effect using spherical balls or other available apparatus.

### Weakness

The 'one molecule thick' idea did not come out in their explanation. Majority explained the formation of the patch as a result of adhesive and cohesive forces between water and oil molecules.

The numerical calculations in (ii) was fairly attempted. However, the qualitative parts of this question were poorly done. Candidates could not describe a method of determining the diameter of the oil drop – which implies these candidates were not exposed to the practical aspects of this experiment. Teachers should note that experimental treatment is a requirement in the syllabus.

### Expected Response

b) (i) When oil drop is placed at the centre of the tray  
Oil spreads on water until it is one molecule thick producing patch;

(ii) Volume of drop  $= \frac{4}{3} \pi r^3$  ( $r$  – is radius of drop);  
Volume of patch  $= \pi R^2 h$  ( $h$  – thickness of molecule);  
 $\frac{4}{3} \pi (0.25)^3 = \pi \times 100^2 \times h$ ;  
 $= 2.1 \times 10^{-6} \text{ mm}$

This value is an estimate because oil does not necessarily spread to one layer and also the big errors in radius of drop and patch;

### Question 3 (b)

(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. (2 marks)