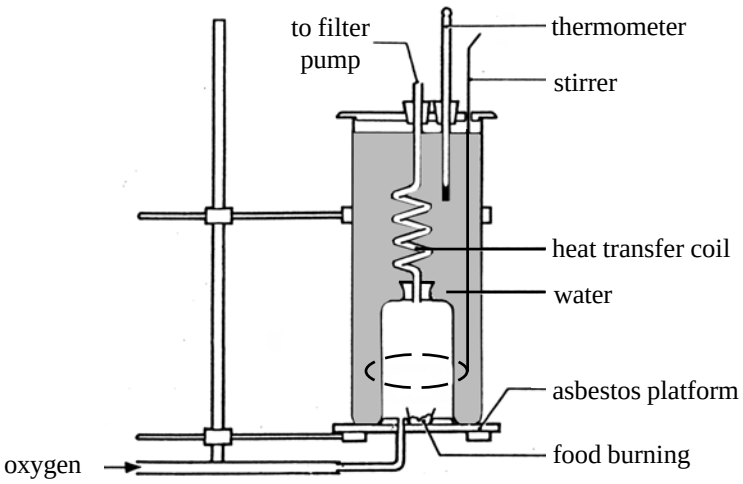
Do not write in margin

The diagram below shows a "bomb calorimeter".



(a) Describe how you would use this apparatus to measure the energy content of a food.

.....

.....

.....

.....

.....

[4]

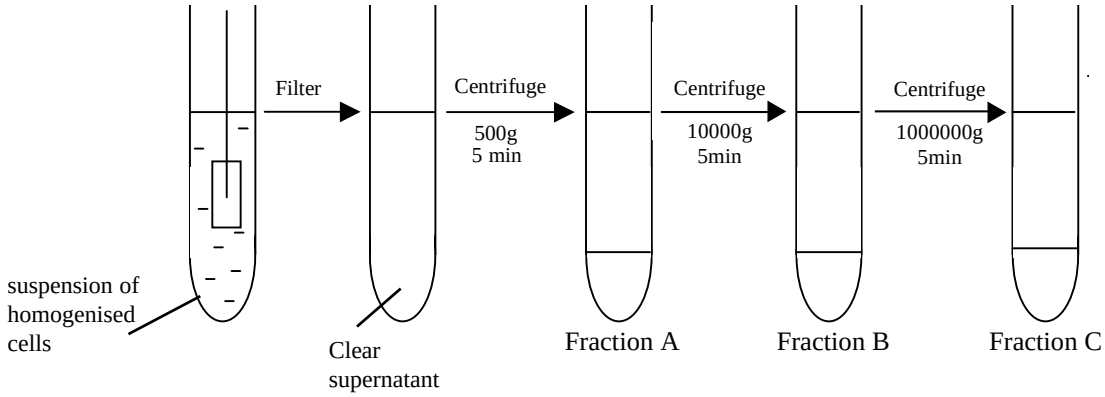
(b) 4.18 Joules raise the temperature of 1 gramme of water by 1^0C. How many kilojoules are produced if 1g of sugar burned in oxygen raises the temperature of 500g of water by 7.5°C? Show your working.

Answer: ..... [3]

TOTAL / 7

Do not write in margin

The diagram below shows how a sample of homogenised eukaryotic cells which were broken down could be separated into their different components.



g = times gravity

(a) State, with a reason which fraction (sediment) is most likely to contain cell nuclei.

.....

.....

[3]

Each fraction was then biochemically analysed. The table below shows some of the results of this analysis.

Fraction	Chemical substances detected
A	Ribulose bisphosphate carboxylase
B	Cytochrome oxidase
C	RNA, ATPase

(b) State, with a reason which fraction is likely to have contained:

(i) mitochondria.

.....

.....

[2]

(ii) ribosomes.

.....

.....

[2]

(c) Suggest with a reason, whether the cells were from an animal or a plant.

.....

.....

[2]

(d) Explain why centrifugation can be used to separate organelles in this way.

.....

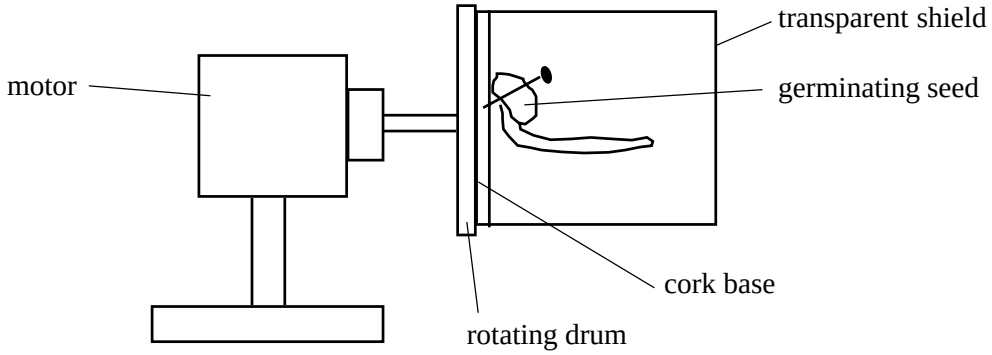
.....

[2]

TOTAL / 11

Do not write in margin

The diagram shows a klinostat which can be used to study tropic growth movements in plants.



(a) (i) Geotropism is the response of shoots and roots to gravity. Name three other types of tropic response in flowering plants in each case saying what the stimulus is.

1. .....

2. .....

3. ..... [3]

(ii) Distinguish between a tropic response and a nastic response in plants.

.....

.....

..... [3]

(b) Describe how you would use the klinostat to demonstrate the responses of germinating bean seeds to gravity.

.....

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.....

.....

..... [5]

TOTAL / 11

Do not write in margin

The minute structure of cells and organisms has mainly been discovered using the light microscope. The ultrastructure of cells and cell components has been discovered using the electron microscope. Electron microscopes may be the transmission type (TEM) or the scanning type (SEM). Microscopes are useful because of their magnifying power and their resolving power.

(a) (i) Distinguish between magnification and resolving power.

.....

.....

.....

[2]

(ii) Complete the table below by placing the following figures in the appropriate boxes

200 μm 5 x 10^6 times 1500 times 1 μm. (μm = micrometers)

	Limit of magnification	Limit of resolution
light microscope		
electron microscope		

[4]

(b) The table below lists certain structures and whether they are visible in the light microscope and electron microscope. If a feature can be seen put a tick (✓) in the appropriate box and if it cannot be seen put a cross (✗)

Feature	Visible in	
	Light microscope	electron microscope
mitochondria		
ribosomes		
viruses		
bacteria		
lysosomes		
hydrogen atoms		

[6]

(c) How do the transmission electron microscope and scanning electron microscope differ in their use?

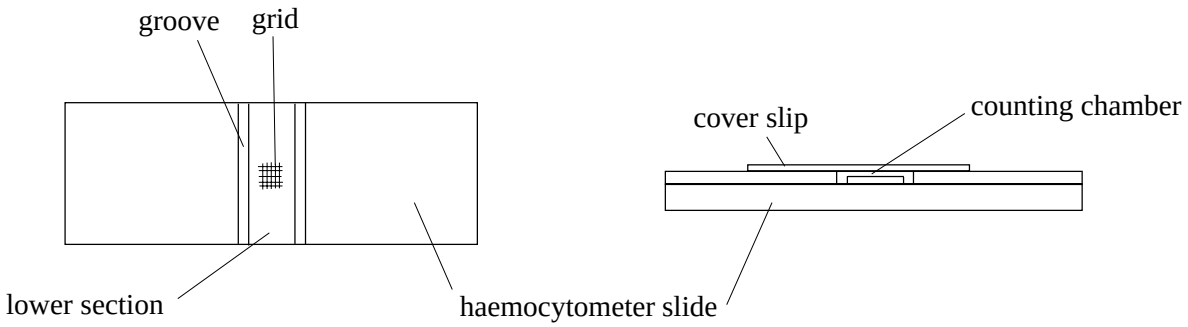
.....

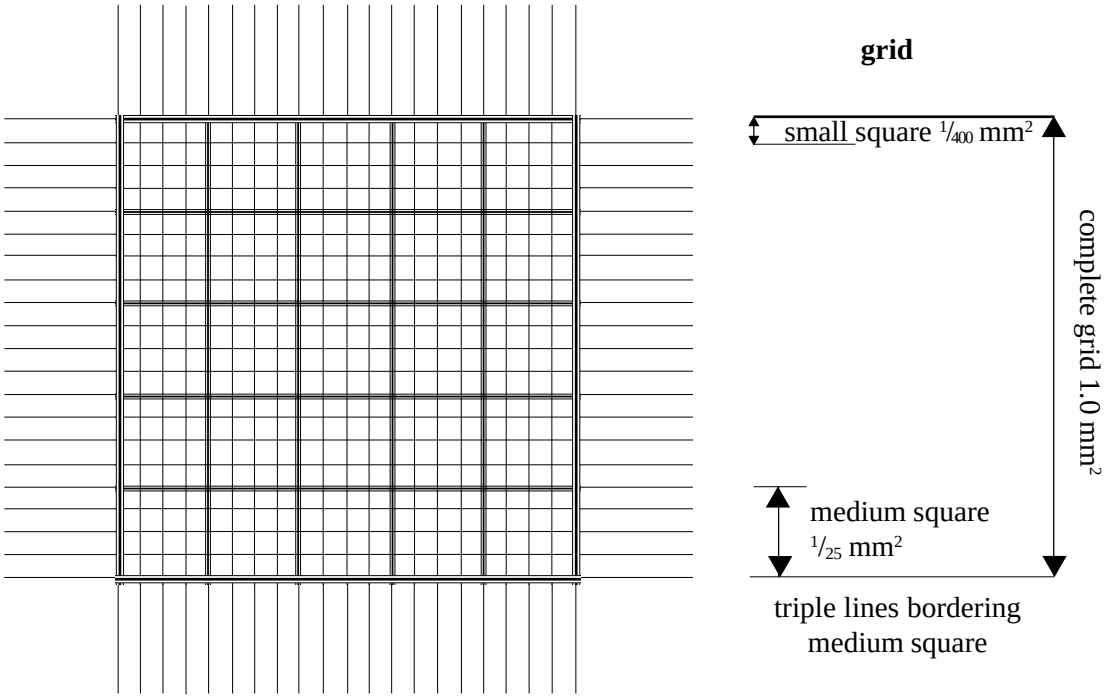
..... [2]

TOTAL / 14

Do not write in margin

The diagrams below illustrate a counting chamber (haemocytometer) for measuring red blood cell counts, white blood cell counts or microbial population counts.





(a) (i) Describe how you would fill the counting chamber with a suspension of cells suspended in isotonic saline.

.....

.....

..... [2]

(ii) Describe how you would set up the counting chamber on a light microscope to view the counting chamber under high power.

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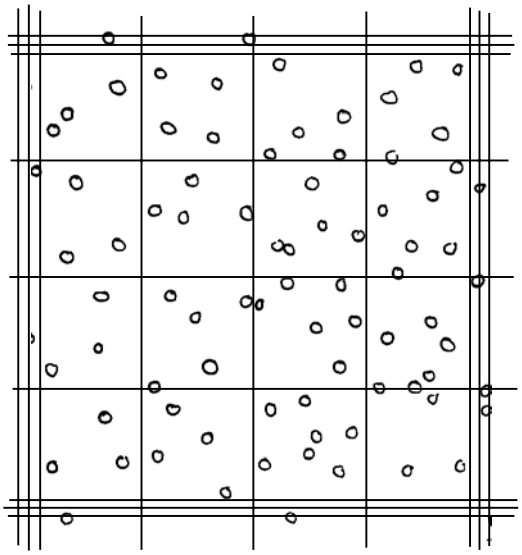
.....

..... [5]

(*Continued...*)

Do not write in margin

(b) The diagram shows part of a haemocytometer grid viewed under the microscope. The counting chamber contains a suspension of bacterial cells. The depth of the film is 0.1 mm.



(i) Calculate the number of bacterial cells in 1 mm^3 of the suspension. Show your working.

Answer: ..... [3]

(ii) The sample had been diluted with isotonic saline by 10^{-5}. Calculate the number of bacterial cells per dm^3 of the original bacterial culture. Show your working.

Answer ..... [2]

(iii) What precaution should be taken when counting the cells in the counting chamber to ensure an accurate count?

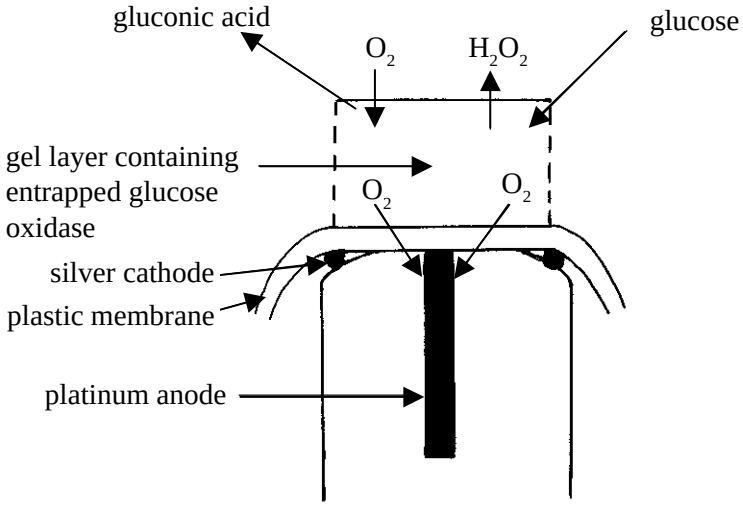
.....

..... [1]

TOTAL / 13

Do not write in margin

The diagram below illustrates an enzyme electrode from a biosensor which can be used for measuring glucose concentrations.



(a) (i) Explain what is meant by the term biosensor.

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..... [2]

(ii) This type of biosensor uses the enzyme ‘glucose oxidase’. Describe the action of glucose oxidase.

.....

..... [2]

(iii) Describe how the biosensor works to measure glucose concentration.

.....

.....

.....

..... [3]

(b) Name a useful application of the glucose biosensor.

..... [1]

TOTAL / 8

QUESTIONSHEET 7

Do not write in margin

The table below refers to the uses of various pieces of apparatus. Complete the table by writing the name of the correct piece of apparatus, selected from the list below, in the relevant box.

Use of apparatus	Apparatus
comparing light absorbances	
looking at virus structure	
measuring glucose concentrations	
measuring stomatal diameter	
measuring vital capacity	
measuring cell population density	
separating ribosomes from mitochondria	
looking at vascular bundles	
sampling invertebrates in leaf litter	
comparing transpiration rates	
separating chloroplast pigments	
measuring plant population density	
measuring blood pressure	
comparing energy contents of foods	

centrifuge
chromatography apparatus
ultracentrifuge
glucose oxidase electrode
spirometer
potometer
quadrat
eyepiece and stage micrometer
light microscope
haemocytometer
sphygmomanometer
bomb calorimeter
tulgren funnel
electron microscope
spectrophotometer
bioreactor

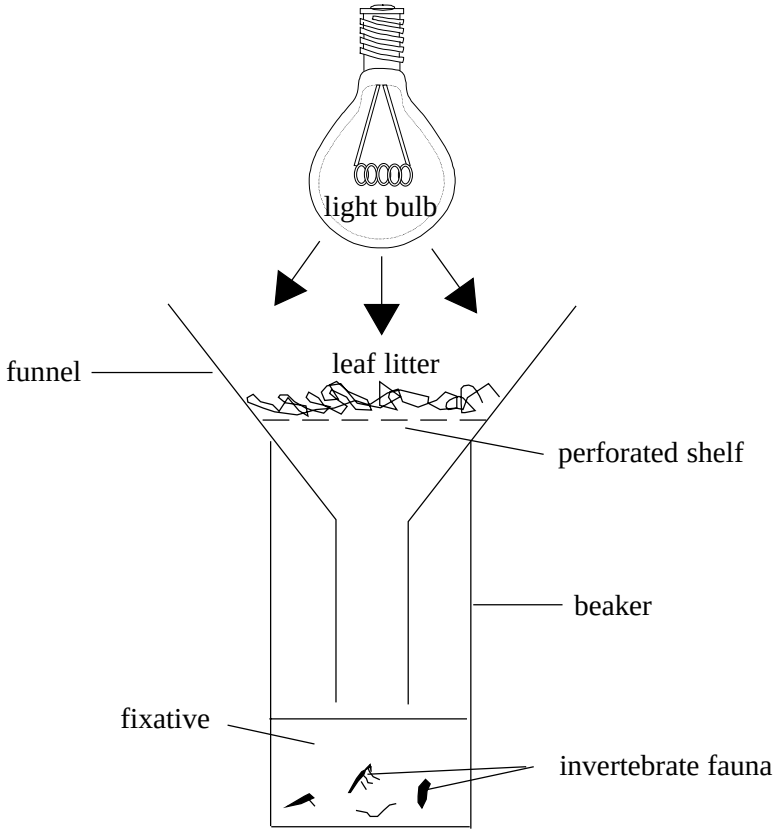
TOTAL / 14

TOOLS AND TECHNIQUES

QUESTIONSHEET 8

Do not write in margin

The diagram below shows a Tulgren funnel which can be used to sample the invertebrate fauna of leaf litter.



(a) (i) Describe how the apparatus works.

.....

.....

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.....

[3]

(ii) What precautions must be taken when using this apparatus?

.....

.....

.....

.....

.....

[4]

(*Continued...*)

Do not write in margin

(iii) What precautions should be taken when collecting leaf litter samples from two sites in a wood for comparison of their invertebrate fauna?

.....

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.....

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.....

.....

[5]

(b) How could a pyramid of biomass be assembled from the data obtained from the Tulgren funnel?

.....

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.....

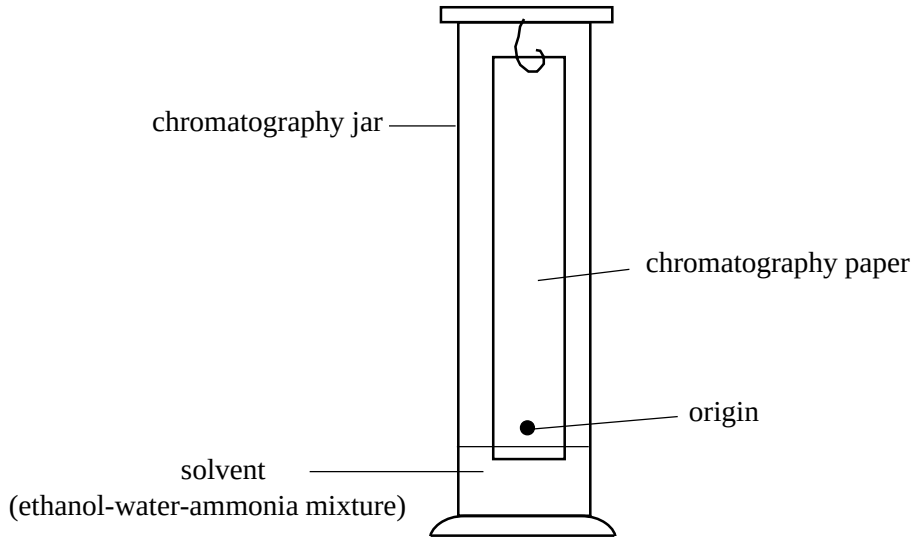
.....

[4]

TOTAL / 16

Do not write in margin

The diagram below shows a chromatography apparatus that could be used to identify the different amino acids in a sample of fruit juice. Since amino acids are invisible, a stain in spray form can be used to colour them.



(a) (i) Describe how the experiment would be set up to separate the amino acids in the fruit juice.

.....

.....

.....

.....

.....

..... [5]

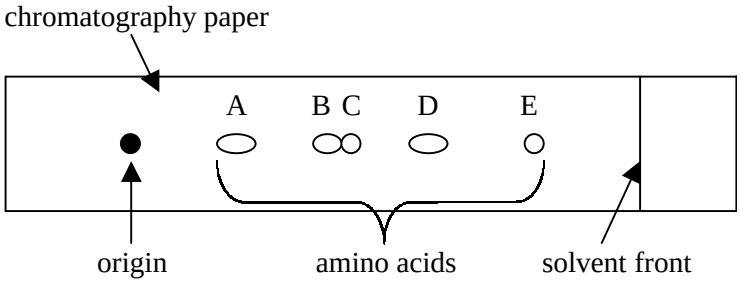
(ii) State two precautions which should be taken when setting up the apparatus.

1. .....

2. ..... [2]

Do not write in margin

(b) After a suitable time the chromatography paper was removed, the solvent front marked and the paper dried in a fume cupboard. It was then sprayed with ninhydrin and dried at 100^0C to locate the amino acids. The Rf values of the amino acids were then measured. The diagram below shows the results that were obtained.



(i) What is meant by the term Rf value?

.....

.....

..... [3]

(ii) The table below gives the Rf values of some common amino acids.

Amino acid	Rf value
Cysteine	0.78
Valine	0.60
Proline	0.43
Arginine	0.20
Threonine	0.35
Lysine	0.14
Methionine	0.55
Phenylalanine	0.68
Serine	0.27
Tyrosine	0.45

Calculate the Rf values of amino acids A, D and E and suggest which they are. Show your working.

A: ..... D: ..... E: ..... [6]

(iii) Amino acids B and C are not clearly separated. Suggest how they may be further separated.

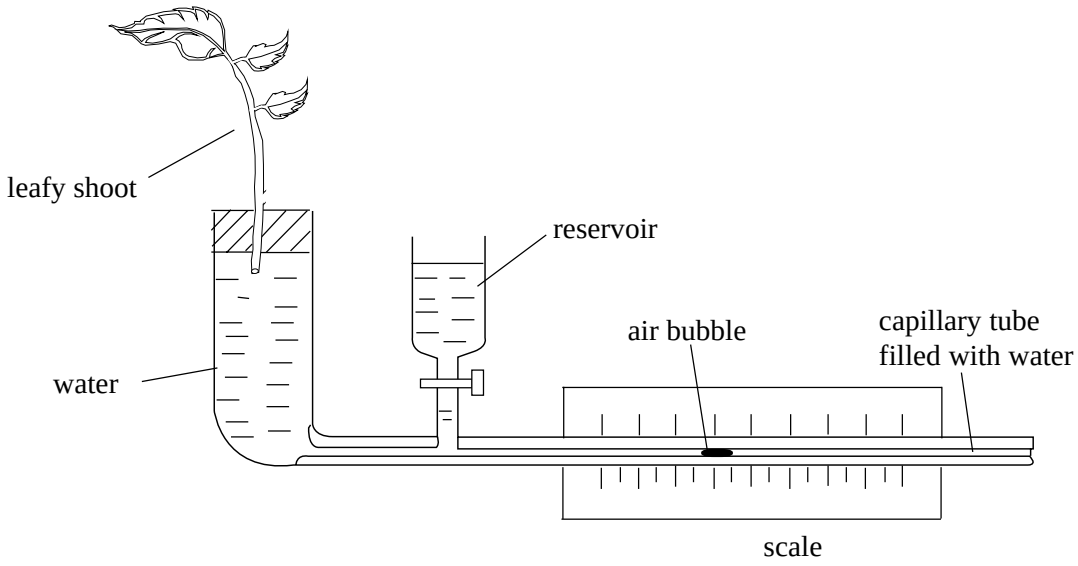
.....

..... [2]

TOTAL / 18

Do not write in margin

The diagram below shows an apparatus that is commonly used to compare the transpiration rates of leafy shoots.



(a) (i) What name is given to this apparatus?

.....

[1]

(ii) 'Although this apparatus can be used to compare transpiration rates it does not actually measure transpiration'. Explain what is meant by this statement.

.....

.....

.....

[2]

(iii) What precautions must be taken when setting up the apparatus?

.....

.....

.....

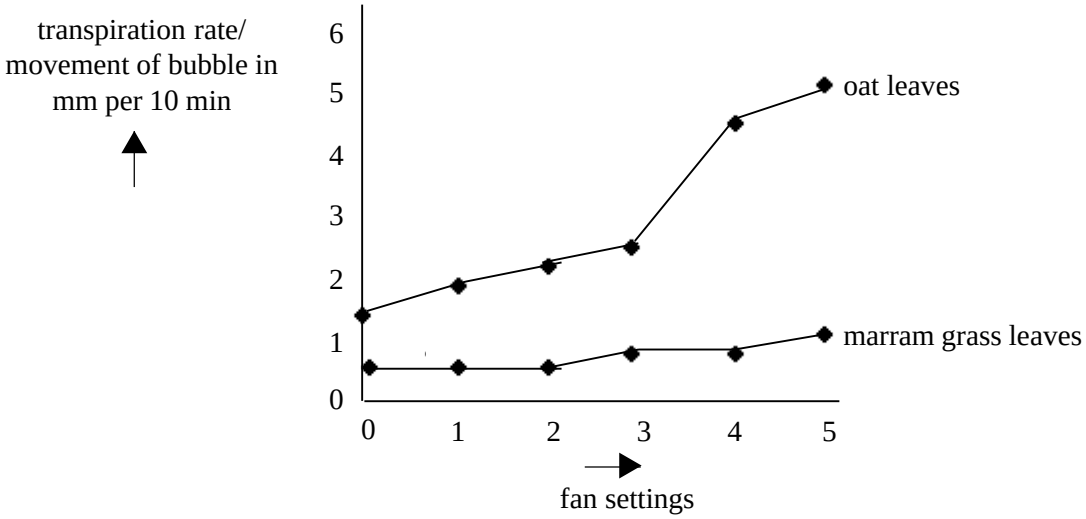
.....

[3]

(*Continued...*)

Do not write in margin

(b) The graph below shows the relative transpiration rates of marram grass leaves and oat leaves in light, in still and moving air. The moving air was generated by a fan set at a standard distance from the leaves. The fan could be set to give different wind speeds. The surface areas of the two leaf samples were similar.



(b) (i) Comment about the results obtained for the oat leaves.

.....

.....

.....

.....

[3]

(ii) Comment on the different response of the two types of leaves to moving air.

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.....

[4]

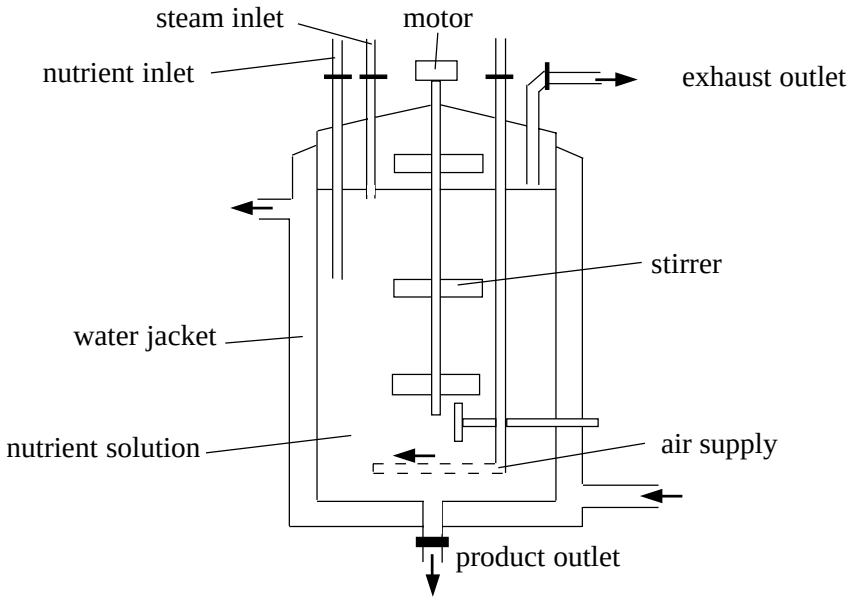
TOTAL / 13

TOOLS AND TECHNIQUES

QUESTIONSHEET 11

Do not write in margin

The diagram below shows an industrial fermenter in which large scale cultures of microorganisms can be grown in suitable nutrient solutions to produce useful products.



(a) Explain why each of the following is needed.

(i) the water jacket: .....

..... [2]

(ii) an air supply: .....

..... [2]

(iii) a steam inlet: .....

..... [2]

(b) (i) Distinguish between batch fermentation and continuous fermentation giving an example of each.

.....

.....

.....

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.....

..... [5]

(ii) Distinguish between primary metabolite and secondary metabolite naming an example of each.

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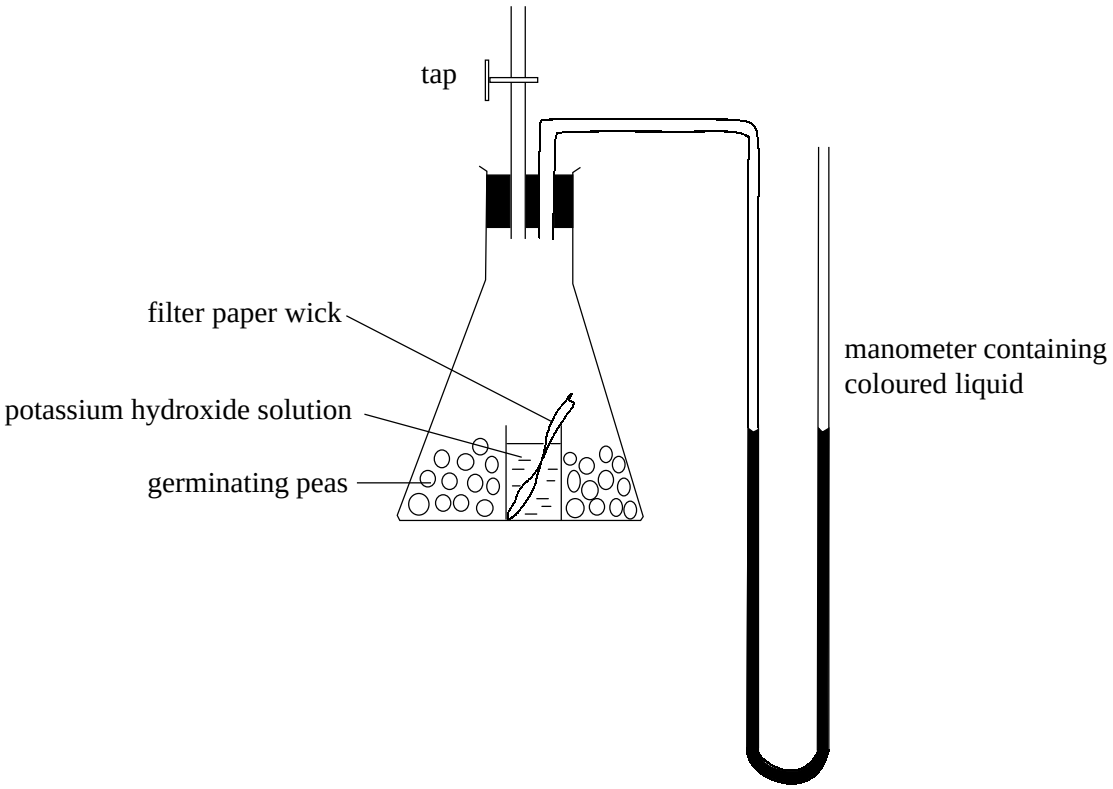
..... [4]

TOTAL / 15

Do not write in margin

The diagram below shows a simple respirometer, suitable for making respiratory measurements on germinating seeds or insect larvae.



(a) (i) What is the function of the potassium hydroxide solution?

.....

[1]

(ii) What is the function of the filter paper wick?

.....

[1]

(iii) What is the function of the tap?

.....

[1]

(b) Describe how the apparatus could be used to assess the effect of temperature on the respiration rate of the germinating seeds.

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.....

[5]

(*Continued...*)

Do not write in margin

(c) (i) What is meant by the term ‘respiratory quotient’?

.....

.....

[2]

(ii) How could the apparatus be used to measure the respiratory quotient of the seeds?

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.....

.....

[4]

TOTAL / 14