Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced Subsidiary/Advanced

WJEC CBAC

CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Addysg Gyffredinol
Uwch Gyfrannol/Uwch

313/01

BIOLOGY PRACTICAL – BI3

SPRING 2007

For examiner's use	
1	
2	
3	
Total	

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided above.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

You are reminded that this is a record of your own work and that no certificate will be awarded to a candidate detected in any unfair practice.

Recommended maximum times:

Question 1 45 minutes

Question 2 1hr 15 minutes implementation, 45 minutes analysis

Question 3 60 minutes

Question 1: Planning. This is a planning exercise only. There is no need to carry out the investigation.

Investigation:

Rhubarb cells can gain and lose water across their cell membranes. The quantity of water which is gained or lost is dependent on the surrounding bathing solution. It is not possible to measure the exact quantity of water that is gained or lost directly, but it is possible to see individual cells under a microscope. By observing the cells carefully you can get an indication of the change in water content of the cells.

The aim of your investigation is to find the solute potential of some rhubarb cells.

(a) Identify the key variables as follows:

(i) Independent variable [1]

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(ii) Dependent variable [1]

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(b) Give a prediction for your investigation which clearly links the two variables in your investigation. [2]

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(c) Briefly describe the biological theory behind your investigation. [4]

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(d) List all the apparatus that you will require to carry out your investigation. [2]

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(e) (i) Draw a diagram of a single plant cell as you would expect to see it after it has been in the distilled water for some time. [1]

(ii) Draw a diagram of a plant cell as you would expect to see it after it has been in 1M sucrose solution for some time.
Clearly label the plasma membrane on your diagram. [2]

(f) Name a variable which must be kept the same throughout your investigation. [1]

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(g) Describe how you would carry out your investigation. It is important to give the essential details for each step that you would use, so that another person could carry out your investigation. [10]

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(h) Safety Risk Assessment.

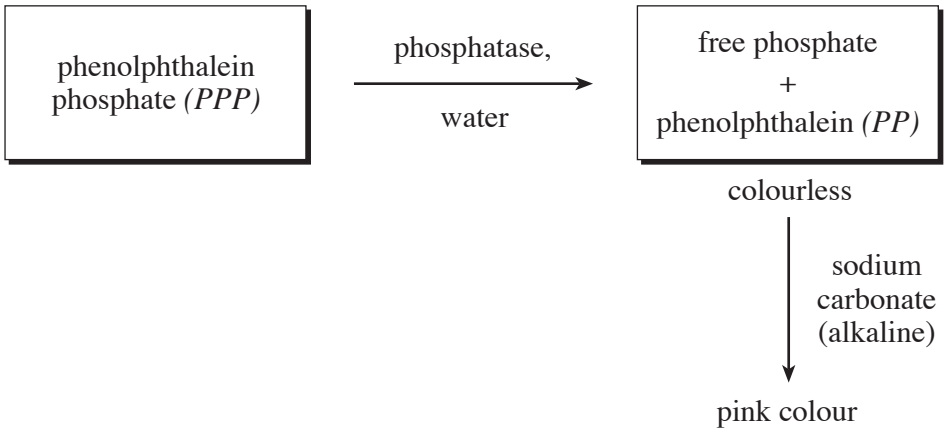
What is the most likely safety risk in this particular investigation? [1]

How can this risk be minimised? [1]

(Total 26 marks)

Question 2: Analysis and Evaluation

This practical involves the action of the enzyme **phosphatase** which reacts with substrates to release phosphate groups. In this investigation the substrate for the enzyme is phenolphthalein phosphate (PPP). Phosphatase reacts with PPP to produce phenolphthalein (PP) and a free phosphate group as shown below.
Both products are colourless in neutral and acid conditions.



When alkaline sodium carbonate is added, the phenolphthalein turns pink and the phosphatase is inactivated.

You are provided with an extract from mung beans which is thought to contain phosphatase.

In this investigation you are going to determine the effect of pH on phosphatase activity. The temperature will be kept constant at 30°C.

You are given:

1. 18 syringes – each with a volume of 2 cm^3.
2. Enzyme extract (approximately 6 cm^3) in a small container (in the water bath).
3. 12 cuvettes.
4. Universal bottle containing exactly 10 cm^3 of buffer at pH 5·0 (in the water bath).
5. Universal bottle containing exactly 10 cm^3 of buffer at pH 7·0 (in the water bath).
6. Solution of sodium carbonate (approximately 20 cm^3).
7. Solution (approximately 6 cm^3) of phenolphthalein phosphate (the substrate) in a small container marked PPP (in the water bath).
8. Stopclock.
9. 2 polystyrene cups and source of warm (30°C) water.
10. Thermometer.
11. Colour chart of phenolphthalein solutions.

Method

Firstly you will run the investigation at pH 5·0 and then you will repeat the investigation at pH 7·0. All solutions should be kept at 30°C during the course of your experiment.

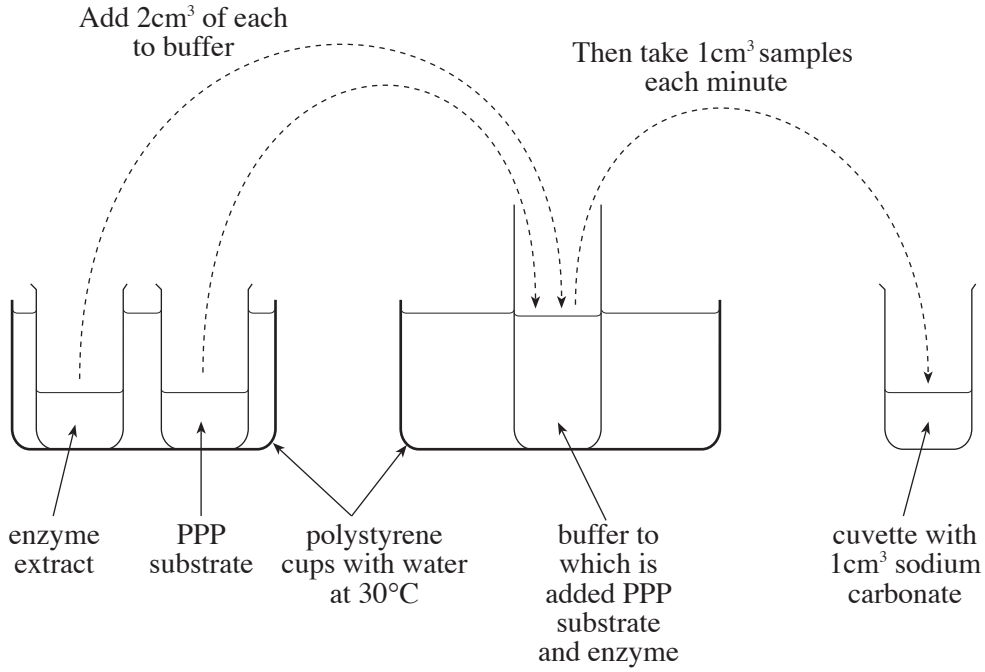
1. Use one syringe to place 1 cm^3 of the sodium carbonate solution into each of 6 cuvettes. Do not use this syringe again.

2. From the water bath, collect two containers marked *Enzyme extract* and *Substrate (PPP)* and keep them in a polystyrene cup which contains approximately 50 cm^3 of water at 30°C (i.e. maintain their temperature).

3. Collect a second polystyrene cup which also contains approximately 50 cm^3 of water at 30°C and place the container marked *Buffer (pH 5·0)* from the water bath into this second polystyrene cup.

4. Use a clean syringe to add 2 cm^3 of *substrate (PPP)* (from the first polystyrene cup) to the buffer.

5. Use a clean syringe to add 2 cm^3 of *Enzyme extract* (from the first polystyrene cup) to the buffer and substrate. **Immediately** start the stopclock. The contents of the bottle should be thoroughly mixed **but** do not shake too vigorously.



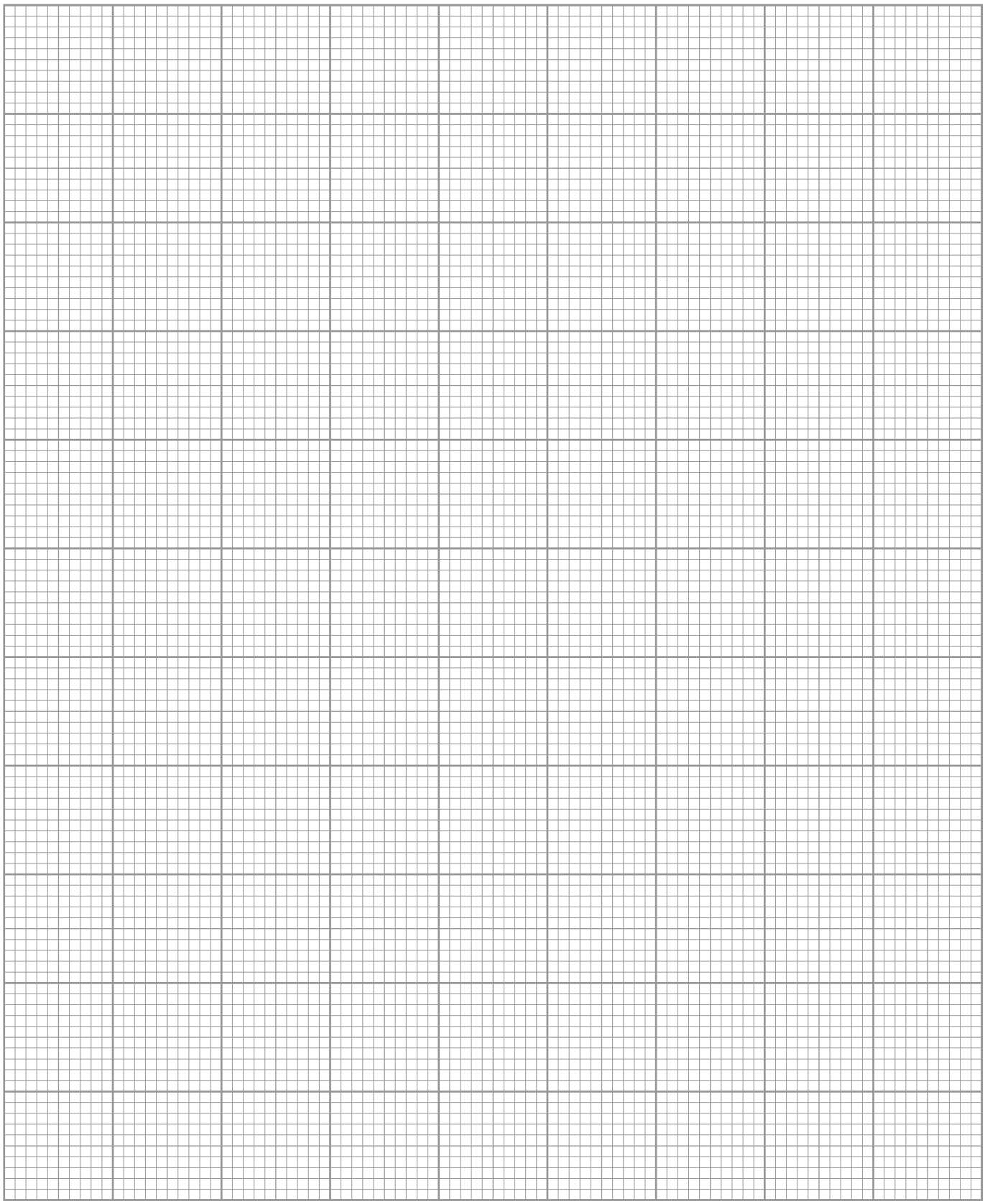
6. At 1 minute intervals (**using a fresh 2 cm^3 syringe each time**), remove 1 cm^3 of the enzyme and substrate mixture, and add it to one of the 6 cuvettes which contains sodium carbonate solution. Use the syringe carefully to mix the contents of the cuvette by taking up and expelling the solution a couple of times. After 6 minutes you should have 6 cuvettes which contain the reaction product.

7. Use the colour chart provided to estimate the concentration of phenolphthalein (PP) in each of your 6 cuvettes, in mol dm^{-3}. Record your results clearly.

8. Repeat the whole investigation but use the buffer at pH 7·0 instead of buffer at pH 5·0.

(a) Below, record your results accurately and clearly. [4]

(b) Plot the results, from your table, for both experiments on the grid below. [7]



(c) (i) Suggest **one** way in which the reliability could have been improved. [1]

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(ii) Suggest **one** way in which the accuracy could have been improved. [1]

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(d) Describe the general pattern shown for each pH and briefly comment upon any difference(s). [3]

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(e) Explain **your** results, in biological terms. [5]

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(f) In a similar experiment the phosphatase was heated to 75°C before being used. What would you expect to happen? Explain why. [2]

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(Total 23 Marks)

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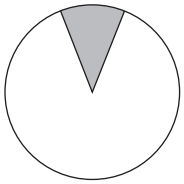
Turn over.

Question 3: Observation and Microscopy

You are provided with the following:

Microscope, eye piece graticule, stage micrometer and a prepared slide of a transverse section (TS) of a primary stem such as *Helianthus*.

(a) Draw a low power plan of part of the stem, as indicated on the diagram below, and which includes vascular bundles. Label your diagram with only the labels you have used as part of your course. [6]



(b) Measure the width of **two** vascular bundles in eye piece units and note the measurements below. [2]
Indicate clearly on your drawing, using **X-X** and **Y-Y**, where you took your measurements.

Vascular bundle 1: **X-X** .....

Vascular bundle 2: **Y-Y** .....

(c) Calibrate the eyepiece graticule at low power. Record all your workings in the space below. All your steps must be clear and easy to follow. [3]

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(d) Using your calibration and your **X-X** vascular bundle measurement from *(b)*, in eye piece units, calculate the actual value for your vascular bundle. [2]

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(e) Calculate the magnification of your drawing using one of your measured vascular bundles, **X-X** from part *(b)*. Show all your workings clearly. [2]

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(Total 15 marks)