Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

**1** Glucose is an important substrate for cellular respiration. Glucose is absorbed into the blood from the small intestine and transported in the blood plasma to the body cells.

You are required to:

- prepare different concentrations of the glucose solution **G**
- carry out the Benedict's test on each of the concentrations of glucose solution you have prepared
- carry out the Benedict's test on the solution representing blood plasma **P**
- use the results of the Benedict's tests to estimate the concentration of glucose in **P**.

You are provided with:

| labelled | contents | hazard | volume/cm$^3$ |
|---|---|---|---|
| **G** | 1% glucose solution | none | 50 |
| **W** | distilled water | none | 70 |
| **P** | unknown concentration of glucose | none | 10 |
| **Benedict's** | Benedict's solution | none | 50 |

**(a)** You are required to make a **serial** dilution of the 1% glucose solution, **G**, which reduces the concentration **by half** between each successive dilution.

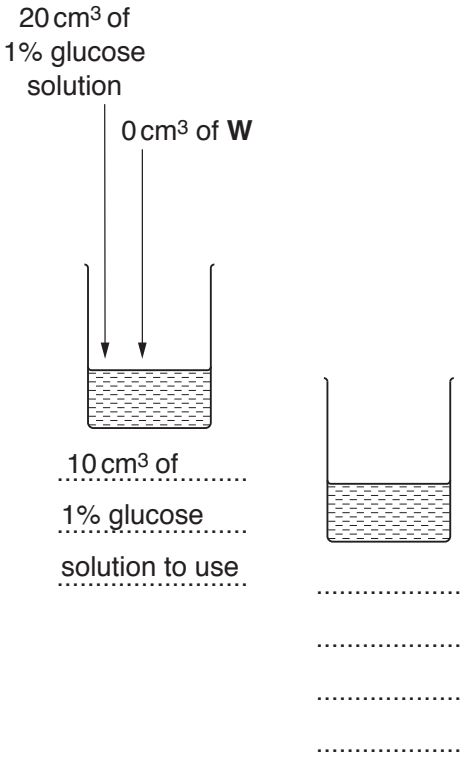
You will need to **prepare** 10 cm$^3$ of each concentration.

Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

**(i)** Complete Fig. 1.1 by drawing the extra beakers you need for your serial dilution.

For each beaker:

- state, under the beaker, the **concentration** and **volume** of the glucose solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **concentration** and **volume** of glucose solution added to prepare the concentration
- use another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.




[3]

**Fig. 1.1**

Proceed as follows:

1. Set up a water-bath and heat to boiling ready for step 6.
2. Prepare the concentrations of glucose solution as shown in Fig. 1.1.
3. Put 2 $cm^3$ of 1% glucose solution into a test-tube.

**(ii)** State the smallest division on the syringe you used in step 3.

.....

State the **actual** error when using this syringe.

.....[1]

Calculate the **percentage** error when using this syringe.

You may lose marks if you do not show your working.

percentage error .....[1]

4. Put 2 $cm^3$ of Benedict's solution into the same test-tube as step 3.

5. Shake the test-tube gently to mix the contents.

*Read step 6 to step 9 before proceeding.*

You are required to:

- observe the contents of the test-tube continuously while the test-tube is heated for 60 seconds
- record the time taken for the **first** appearance of a colour change, if a colour change occurs during this 60 seconds
- record the colour **after** heating for 60 seconds.

6. Put this test-tube into the water-bath you prepared in step 1 and start timing.

7. Record the **time taken** for the first appearance of a colour change in Table 1.1.
*Do **not** stop the clock and continue heating until 60 seconds.*

If there is no colour change after 60 seconds record the time as 'more than 60'.

8. At 60 seconds remove the test-tube from the water-bath, gently shake, and record the **colour** of the Benedict's solution in Table 1.1.

9. Repeat step 3 to step 8 for each of the glucose solutions you prepared in step 2.

*You are not required to repeat this experiment.*

**(iii)** Complete the column headings and record your results in Table 1.1.

**Table 1.1**

| | time taken for the first appearance of a colour change / ..... | colour of Benedict's at 60 seconds |
|---|---|---|
| | | |

[4]

**(iv)** Describe how you will standardise the Benedict's test in order to enable you to estimate the concentration of glucose in **P**.

.....

.....

.....

.....[2]

10. Repeat step 3 to step 8 using solution **P**.

**(v)** Record your results for solution **P**.

time taken for the first appearance of a colour change .....

colour of Benedict's at 60 seconds .....[1]

**(vi)** Estimate the concentration of glucose in **P**, using the colour of Benedict's at 60 seconds recorded in Table 1.1 and **(a)(v)**.

.....[1]

**(vii)** Describe **one** improvement to allow a more accurate estimate of the concentration of glucose in **P** to be obtained using the **colour** of Benedict's at 60 seconds.

.....

.....

.....[1]

**(viii)** Describe how your results for the **time** taken for the first appearance of a colour change can be used to produce a more accurate estimate of the concentration of glucose in **P** than the one given in **(a)(vi)**.

.....

.....

.....

.....

.....[2]

**(b)** A scientist studied the change in the concentration of glucose in blood plasma after eating a meal containing carbohydrate. Samples of blood plasma were taken at regular intervals after eating the meal and the concentration of glucose in each sample was measured.

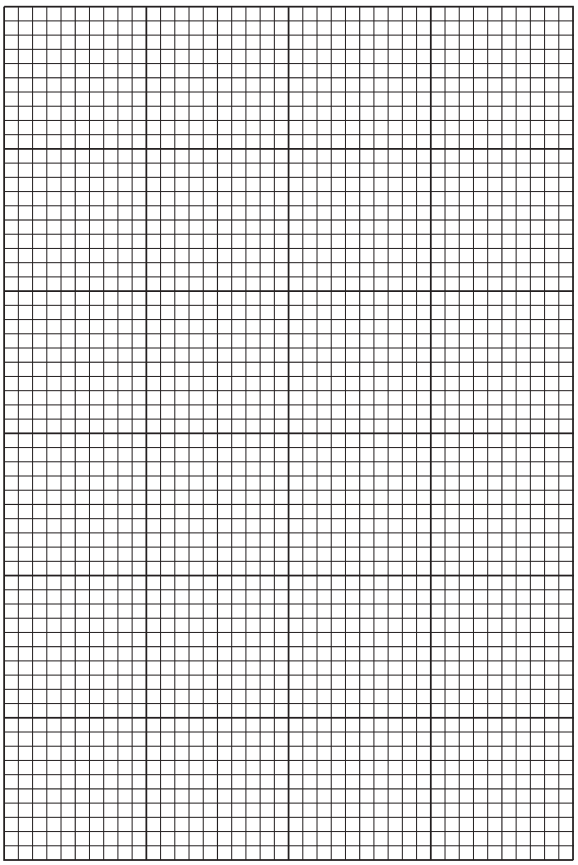
The results are shown in Table 1.2.

**Table 1.2**

| **time after eating the meal / minutes** | **concentration of glucose in blood plasma / mmol $dm^{-3}$** |
|---|---|
| 0 | 5.125 |
| 20 | 6.750 |
| 40 | 7.600 |
| 60 | 7.475 |
| 80 | 7.100 |

*You are required to use a sharp pencil for graphs.*

**(i)** Plot a graph of the data shown in Table 1.2.



[4]

**(ii)** Calculate the percentage increase in concentration of glucose in the blood plasma between 0 minutes and 20 minutes after eating the meal.
You may lose marks if you do not show all your working.

percentage increase .....[1]

**(iii)** Use **one** label line and the label **X** to show on the graph where the rate of diffusion of glucose into the blood is most rapid. [1]

**(iv)** Suggest **one** reason for the concentration of glucose in blood plasma decreasing between 60 minutes and 80 minutes after eating the meal.

.....

.....

.....[1]

[Total: 23]



**[Turn over**