Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

(a) A student investigated a method for estimating the concentration of protein in solution by using a measure of the density of the solutions.

Copper sulfate solutions of different concentration have known densities, so they can be used to measure the density of other solutions.

The student prepared a dilution series of a copper sulfate solution.

Complete **Table 1** by giving all headings, units and volumes required to make 30 cm^3 of the concentration of the copper sulfate solution shown.

Table 1

Concentration of copper sulfate solution / g kg^{-1}	**Volume of 100 g kg^{-1} copper sulfate solution /** _____	**Volume of water /** _____
75	_____	_____

(2)

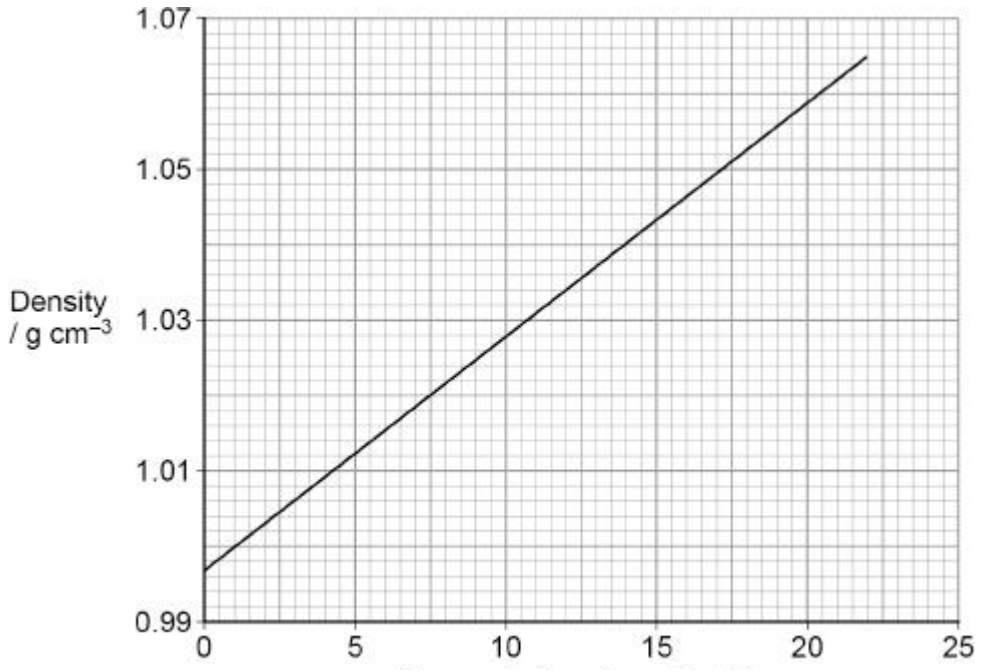
(b) **Table 2** shows the densities of the dilution series of the copper sulfate solution.

Table 2

Concentration of copper sulfate solution / g kg^{-1}	**Density of solution / g cm^{-3}**
0	0.997
25	1.014
50	1.030
75	1.048
100	1.065

The graph below shows the densities of protein solutions of different concentration.

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The student put one drop of 10% protein solution into each of the copper sulfate solutions shown in **Table 2**.

Using the graph, he predicted that the drop would sink in the 0 and 25 g kg^{-1} copper sulfate solutions and float in the 50, 75 and 100 g kg^{-1} copper sulfate solutions.

Give the density of the 10% protein solution **and** explain why the student predicted that the drop would sink in the 25 g kg^{-1} copper sulfate solution.

Density of 10% protein solution _____ g cm^{-3}

Explanation _____

_____

_____

_____

_____

_____

(2)

(c) State the range of possible concentrations of a protein solution that sinks in 75 g kg^{-1} copper sulfate solution and floats in 100 g kg^{-1} copper sulfate solution.

Minimum concentration _____ %

Maximum concentration _____ %

(1)

(d) Blood donation involves healthy donors giving blood that can be used to treat hospital patients.

When donors arrive, the haemoglobin concentration of their blood is tested.

A sample of each donor's blood is added to a copper sulfate solution to determine whether the haemoglobin concentration is high enough to donate.

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Errors sometimes occur with this test.

Tom has a concentration of haemoglobin high enough to donate.

Lucy has a concentration of haemoglobin too low to donate.

Evaluate the consequences of errors occurring when Tom's and Lucy's blood samples are tested.

Consequences of measurement error for Tom's blood _____

_____

_____

_____

_____

_____

Consequences of measurement error for Lucy's blood _____

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(3)

(Total 8 marks)

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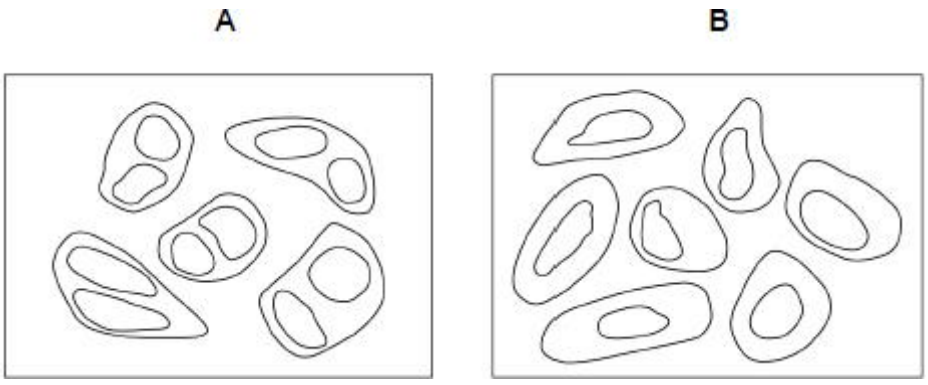
Q2.

(a) Scientists investigated a drug called MiTMAB as a treatment for cancer. MiTMAB inhibits cytokinesis.

Figure 1 shows drawings of cancer cells seen with an optical microscope from a:

- sample treated with MiTMAB
- control sample.

Figure 1



The cells in drawing **A** can be identified as those treated with MiTMAB.

Explain why.

_____

_____

_____

_____

_____

_____

(2)

(b) MiTMAB acts as a non-competitive inhibitor of an enzyme called dynamin.

Suggest how MiTMAB can cause dynamin to become inactive.

_____

_____

_____

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_____

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(3)

When active, dynamin has **two** functions:

- it stimulates cytokinesis
- it inhibits cell death.

The scientists treated actively growing cultures of cancer cells with MiTMAB.

They incubated:

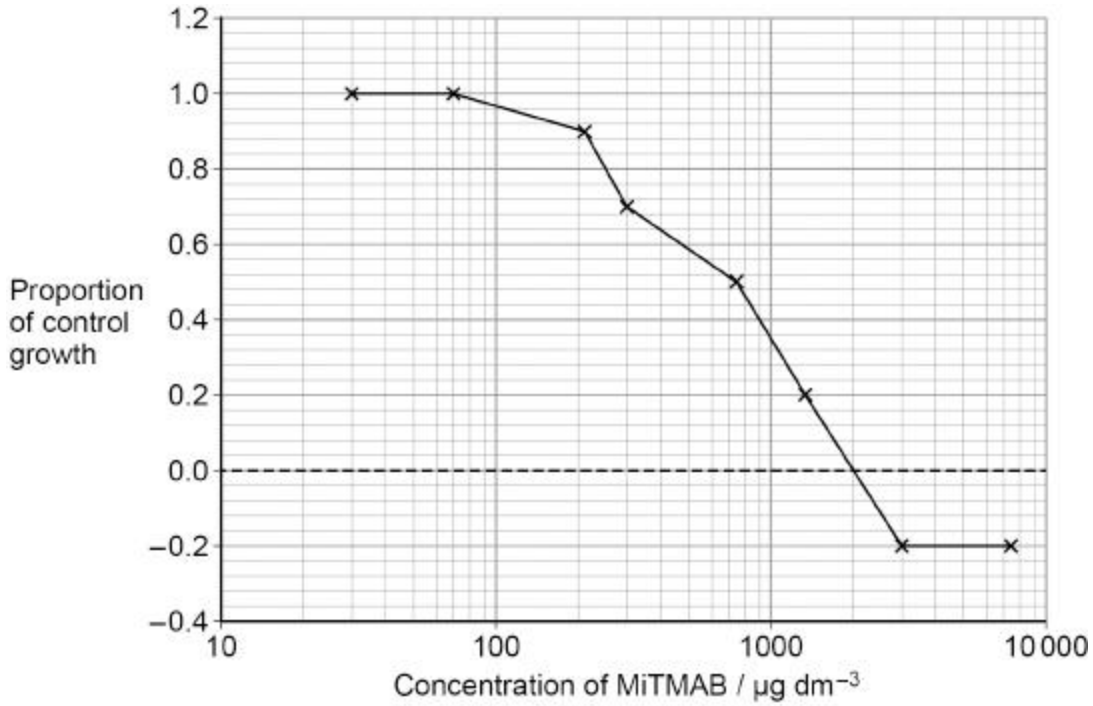
- one sample of 2500 cells without MiTMAB as a control
- eight samples, each with 2500 cells and a different concentration of MiTMAB.

After 72 hours, the scientists measured the number of cells in each sample.

Figure 2 shows the scientists' results.

A negative value for proportion of control growth means that fewer than 2500 cells were counted after 72 hours.

Figure 2



(c) Use all the information given to explain the results shown in **Figure 2**.

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_____

_____

_____

(3)

(d) 0.01 dm^3 of MiTMAB solution was added to the treated cells.

Calculate the increase in mass of MiTMAB (in μg) added to the cells to reduce the cell growth from equal to the control to 0.0 of the control.

Show your working.

Answer _____ μg

(2)

(Total 10 marks)

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