GRAPH WORK PRESENTATION

553/1 BIOLOGY THEORY

BY KADIBA EMMANUEL

PLOTTING GRAPHS

Check list

Your graph must have the following components

P → Plotting

A → Axes

C → Curve

T → Title

S → Scale

Sample question

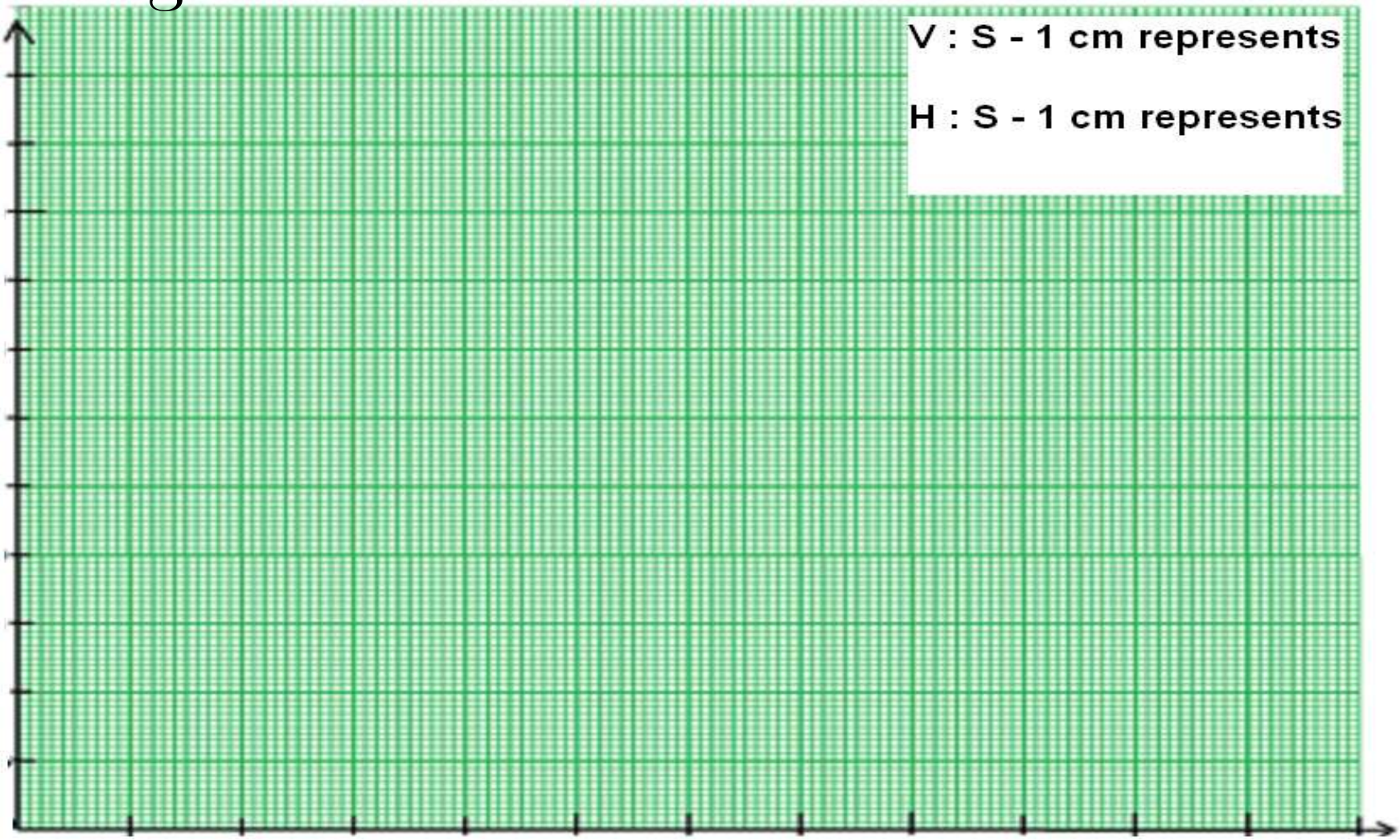
The table below shows the concentration in blood glucose level after a meal.

TIME (MINUTES)	0	20	40	60	80	100	120
Blood glucose Mg/100 cm3	90	95	115	140	110	100	90

a) Represent the information on a graph (6 marks).
b) Describe the variation of blood glucose in the blood after a meal (3 marks)
c) Explain your description (6 marks)
d) Use the graph to obtain blood glucose level after 30 minutes (1 mark)
e) State the clinical name , condition for consistently high level of blood glucose in blood (1 mark)
f) Suggest any three symptoms of this condition. (3 mark)

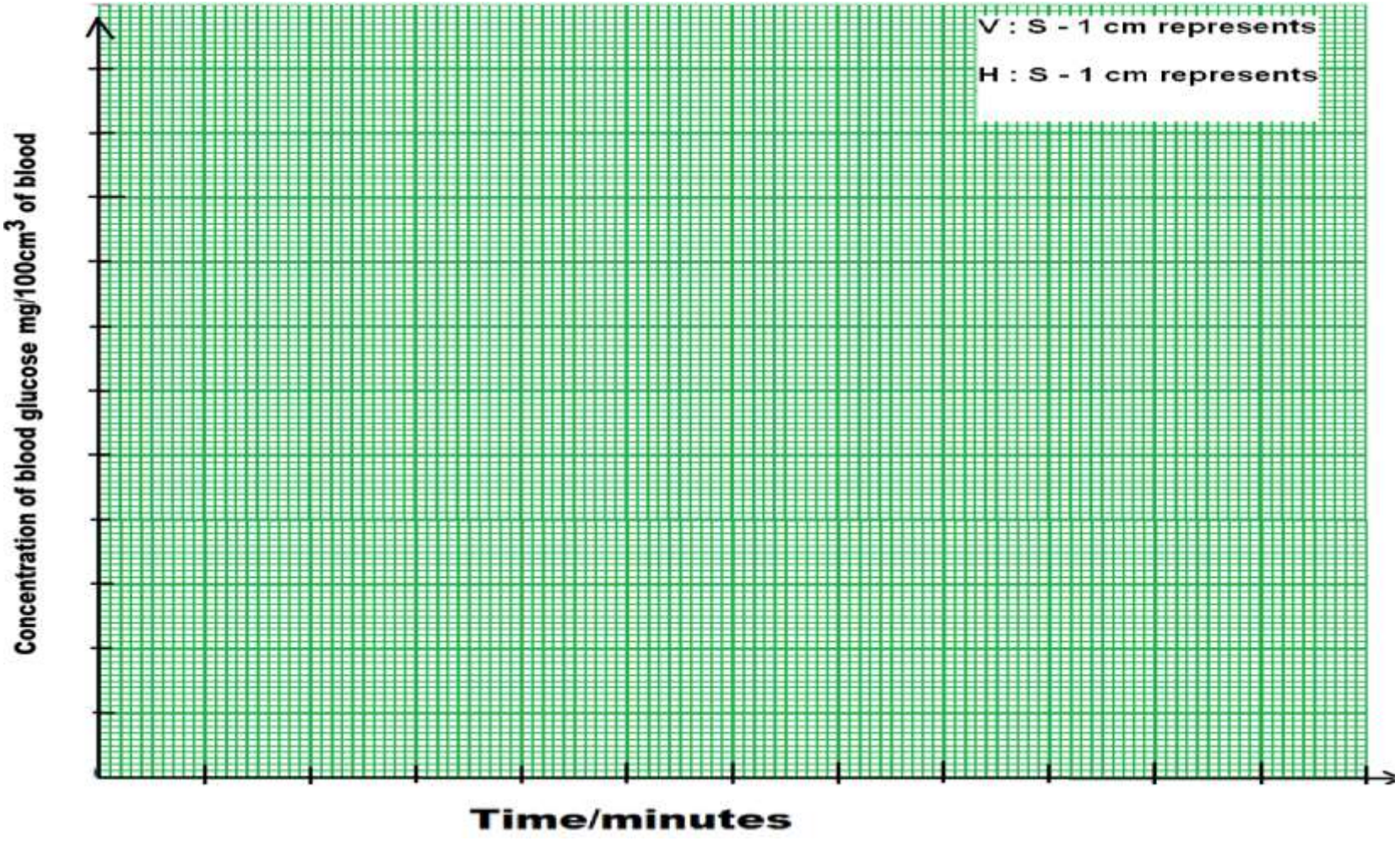
STEP 1- Calibration of the axes

Calibrate both axes covering 10 cm using a ruler



STEP 2 – Identification of the dependent and independent variables

The dependent variable (The result) is written in the vertical axes while the independent variable is written on the horizontal axis.

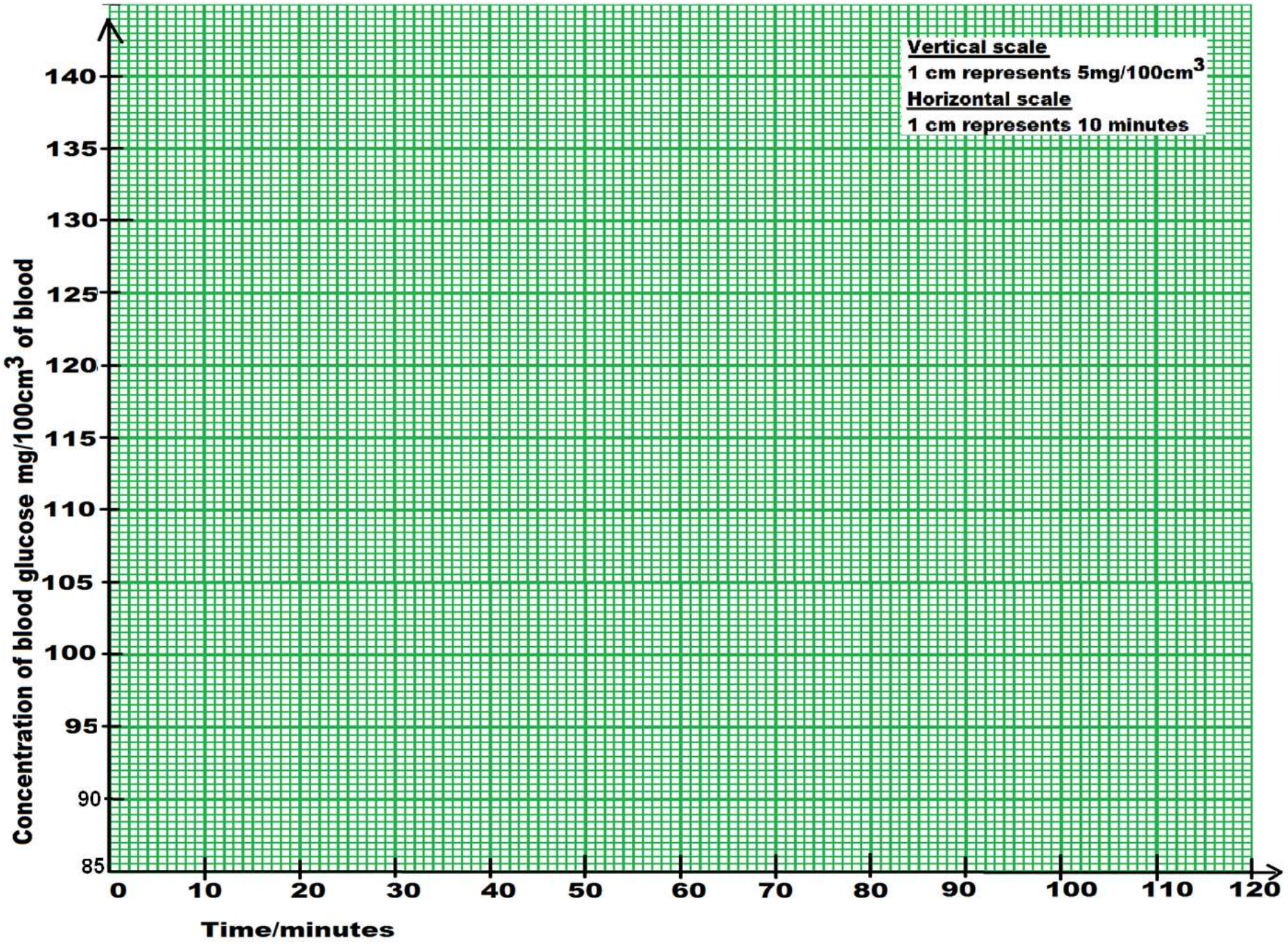


STEP 3 – Obtaining the scale

This can be done by dividing the range by the number of centimeters that have been calibrated.

For the horizontal scale it is $^{120-0}/_{10}$ which is **12**. So we can say **1 cm represents 10 minutes** because plotting 10 is easier than plotting 12.

On the vertical scale it is $^{140-90}/_{10}$ which is **5**. So the scale is **1 cm represents 5milligrams of glucose per cubic centimeter of blood**. Because the values in the vertical axes are overcrowded between 140 and 90, the correct shape of the graph can only be obtained by starting with 85 milligrams of glucose per minute. This is obtained by subtracting 5 from 90 which is the lowest value.


Vertical scale
1 cm represents 5mg/100cm3
Horizontal scale
1 cm represents 10 minutes
Concentration of blood glucose mg/100cm3 of blood
140
135
130
125
120
115
110
105
100
95
90
85
0
10
20
30
40
50
60
70
80
90
100
110
120
Time/minutes

THE DOS AND DONTS OF WRITING SCALES

The scale should begin with 1cm to represent a variable e.g. **1 cm represents 1 kg**

The scale **SHOULD NOT** be written as;

2cm represents 1kg,

1 small square represents 2kg,

1cm reps 1kg

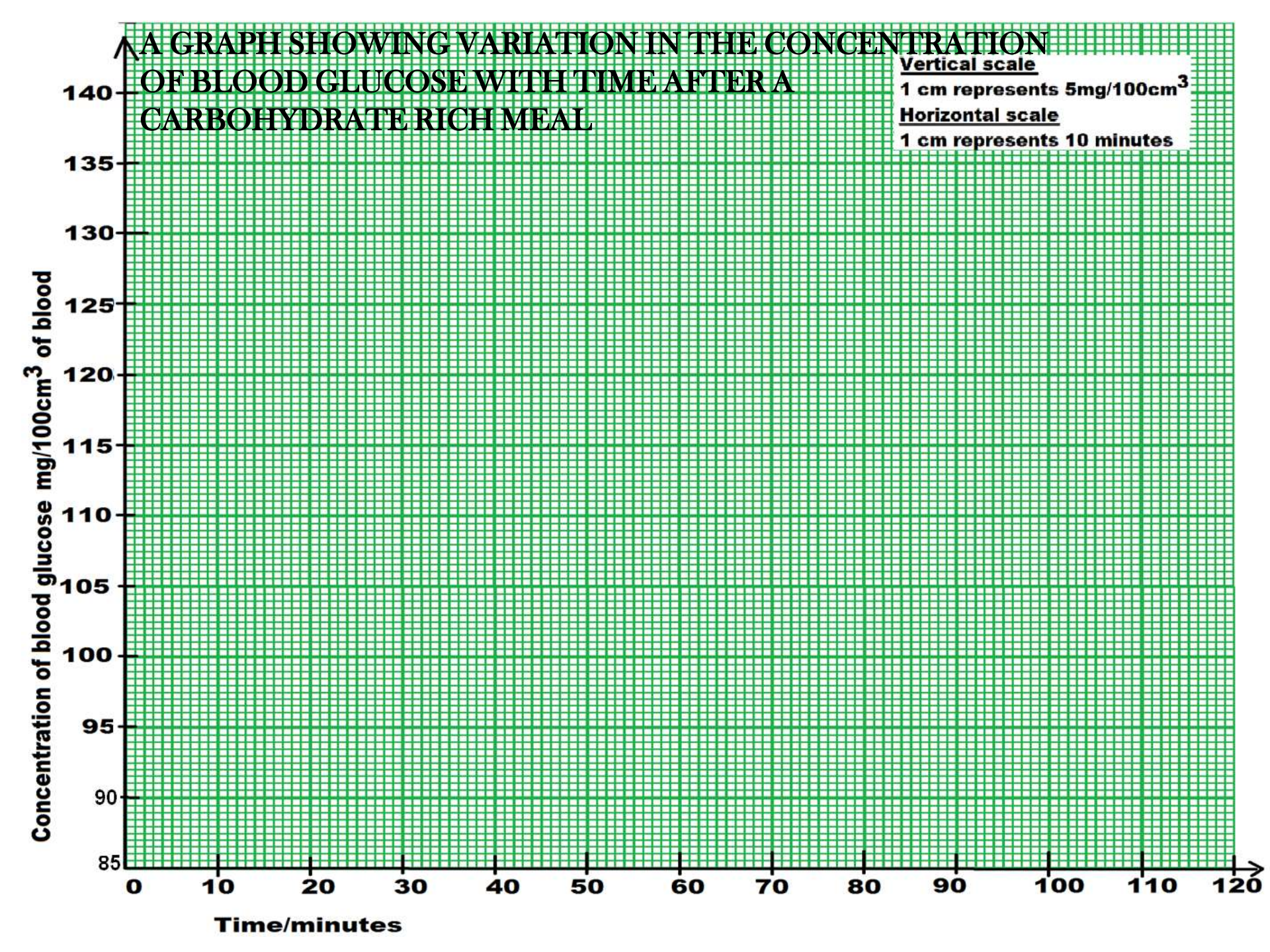
1cm represents 1 unit

1 cm:1 kg

STEP 4 - TITLE

The title of the graph must clearly be written in any of the following ways

- A graph showing the effect of independent variable on the dependent variable .
- A graph showing the relationship between the independent variable and the dependent variable or vice versa.
- A graph showing the variation of the dependent variable with independent variable.
- When the independent variable has time as a unit the title should always be a graph showing the variation/ changes of the dependent variable with time.

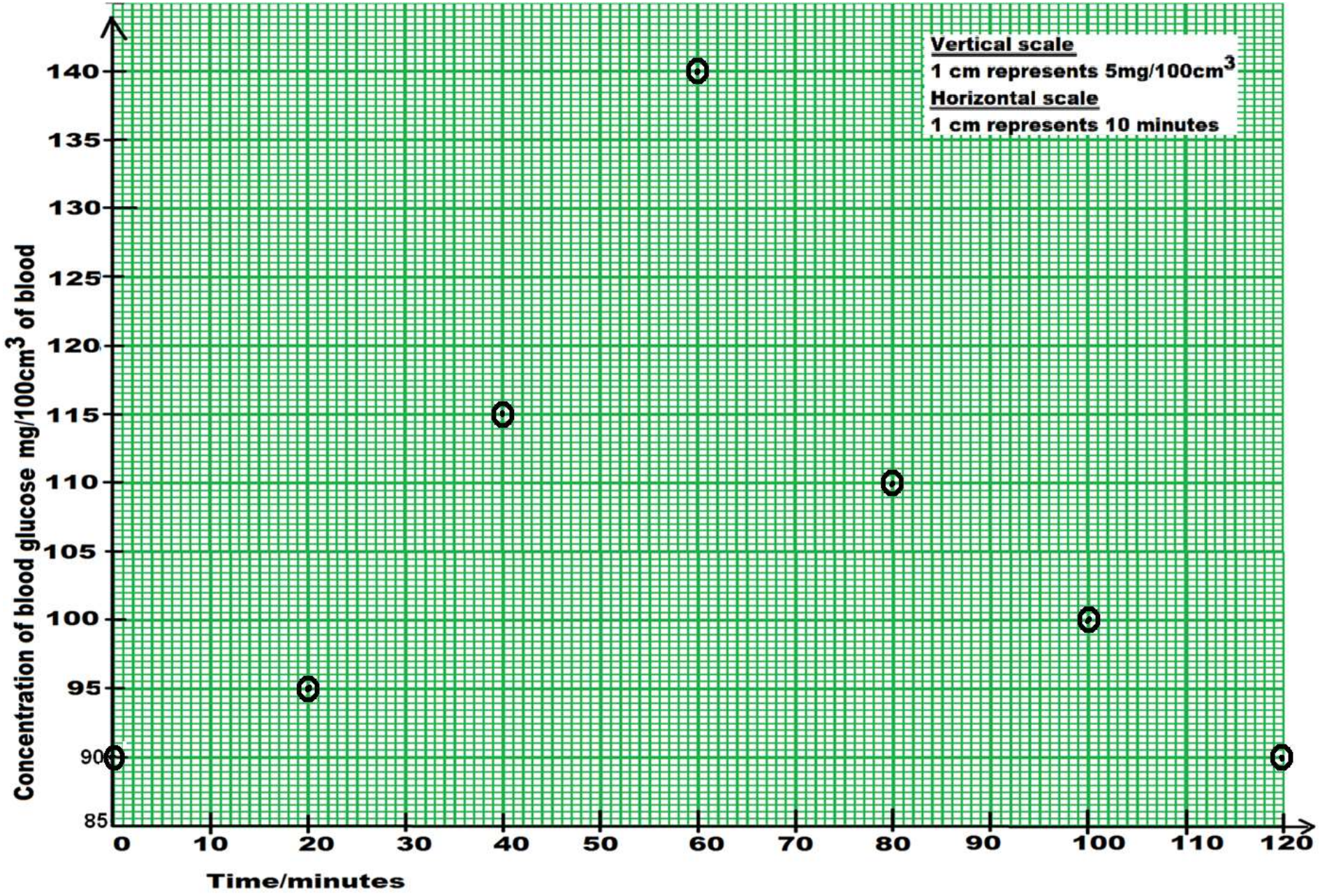

A GRAPH SHOWING VARIATION IN THE CONCENTRATION OF BLOOD GLUCOSE WITH TIME AFTER A CARBOHYDRATE RICH MEAL
Vertical scale
1 cm represents 5mg/100cm3
Horizontal scale
1 cm represents 10 minutes
Concentration of blood glucose mg/100cm3 of blood
140
135
130
125
120
115
110
105
100
95
90
85
0
10
20
30
40
50
60
70
80
90
100
110
120
Time/minutes

STEP 5 - PLOTTING

Before plotting, the student must first identify the **dependent variable (results/effects)** and the **independent variable (cause)**.

- **The independent variable e.g. temperature must be plotted on the horizontal (X-axis) while the dependent variable (results, effect) must be plotted on the vertical (Y-axis).**
- The points plotted (coordinates) should be marked clearly.
- The value of the independent variable on the X-axis is **plotted first** then followed by that on the Y-axis.

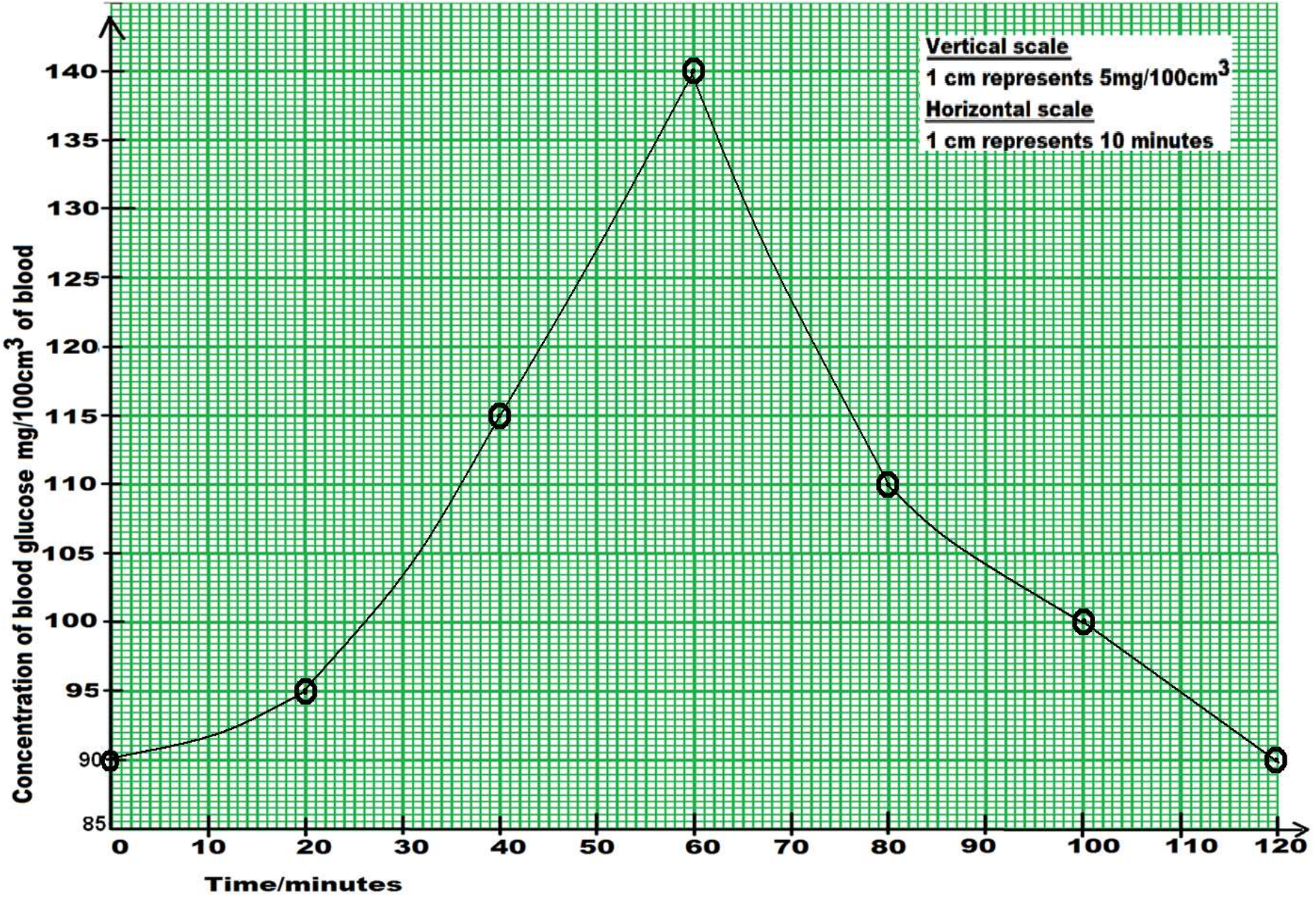
A GRAPH SHOWING VARIATION IN THE CONCENTRATION OF BLOOD GLUCOSE WITH TIME AFTER A CARBOHYDRATE RICH MEAL



STEP 6 – THE CURVE

The co-ordinates plotted must be joined with a pencil using free hand to form a smooth Curve or a straight line.

A GRAPH SHOWING VARIATION IN THE CONCENTRATION OF BLOOD GLUCOSE WITH TIME AFTER A CARBOHYDRATE RICH MEAL



DESCRIPTION OF GRAPHS

Description involves stating the pattern shown by the dependent variable in a line graph.

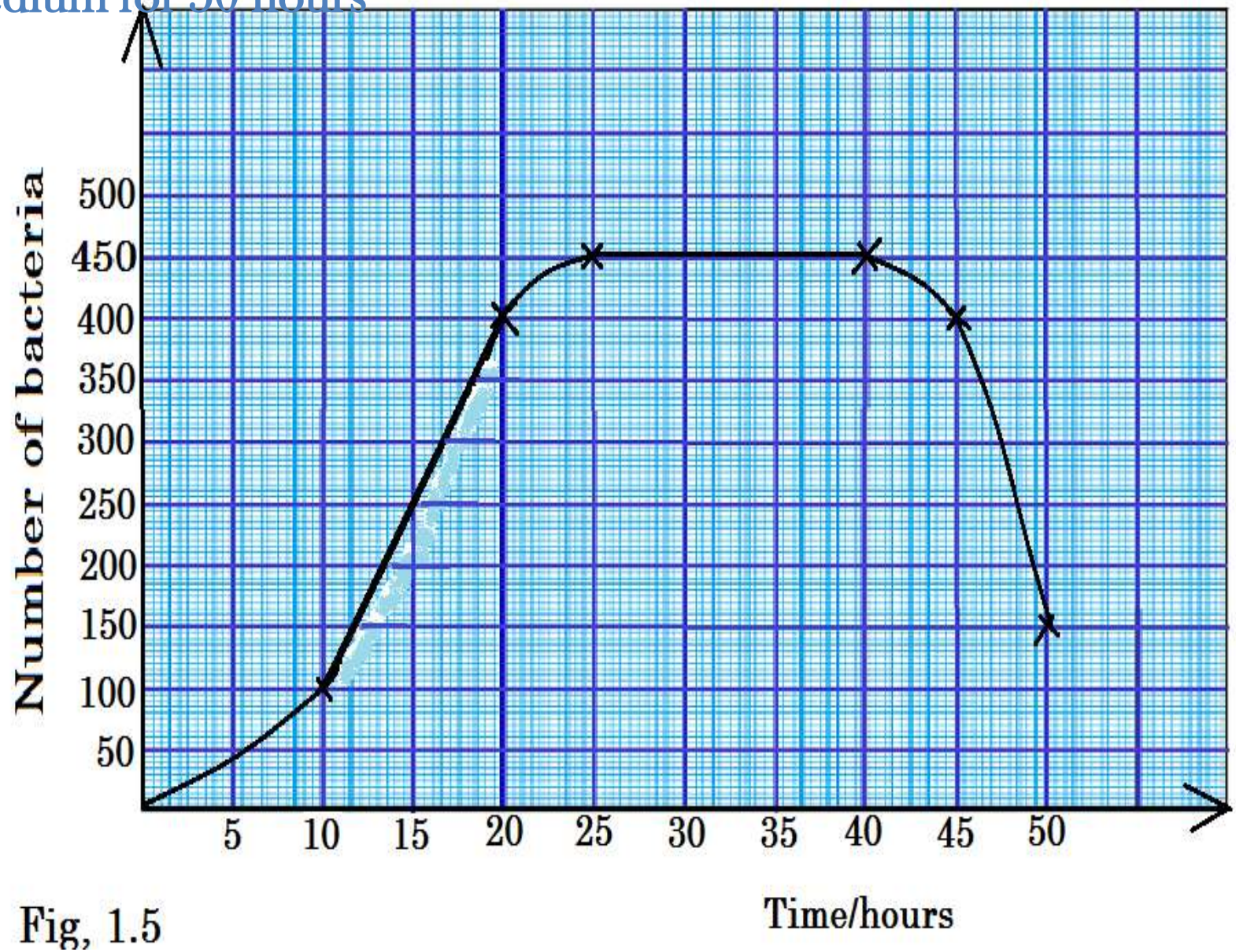
The dependent variable (results) can increase, decrease or remain constant. During description the increase, decrease must be qualified e.g. rapid increase, rapid decrease, gradual decrease, gradual indecrease or remains constant.

The independent variable on the other hand starts from a certain value and increases or decreases towards 0. The increase or decrease should not be qualified. In case there are figures, the figures must be quoted.

The independent variable should be described first followed by the dependent variable. This is because it is the independent variable which causes an effect on the dependent variable for example increase in high intensity (independent variable) leads to an increase in the rate of photosynthesis (dependent variable) not increase in the rate of photosynthesis leading to increase in light intensity.

Example 1

The graph below shows the population growth of bacterial cells in active medium for 50 hours



Fig, 1.5

Questions

1.Describe the graph

2.Explain the graph

Solutions

Hints:

The dependent variable is the population while the independent variable is the time.
The independent variable has values and these values should be quoted during the description.
The changes in the dependent variable should be qualified.
The independent variable described first followed by the dependent variable.

1.Description of the graph

From 0 to 10 hours, bacterial population increases gradually.
From 10 to 20 hours bacteria population increases rapidly.
From 20 to 25 hours bacteria population increases gradually.
From 25 to 40 hours, bacteria population remains constant.
From 40 to 45 hours, bacteria population decreases gradually.
From 45 to 50 hours, bacterial population decreases rapidly.

NOTE: It is not desirable to say bacteria population increases from 0 – 20 hours and decreases from 40 – 50 hours without qualifying the increase or decrease.

UNDESIRABLE WORDS IN DESCRIPTION

The graph is increasing, you should state **what is increasing** or **decreasing** and **how the increase** or **decrease is taking place**.

The graph is **accelerating, falling, decelerating, climbing** etc.

The graph is **increasing drastically, sharply, exponentially,** etc.

EXPLANATION OF GRAPHS

Explanation

Hints: Before explaining a graph you should first give a brief description, starting the pattern of the dependent variable followed by the explanation for the pattern.

2. Explanation of the graph

From 0 to 10 hours, bacterial population increases gradually because reproducing individuals are still young and few.

From 10 hours to 20 hours the bacterial population increases rapidly due to availability of enough food, water and absence of competition.

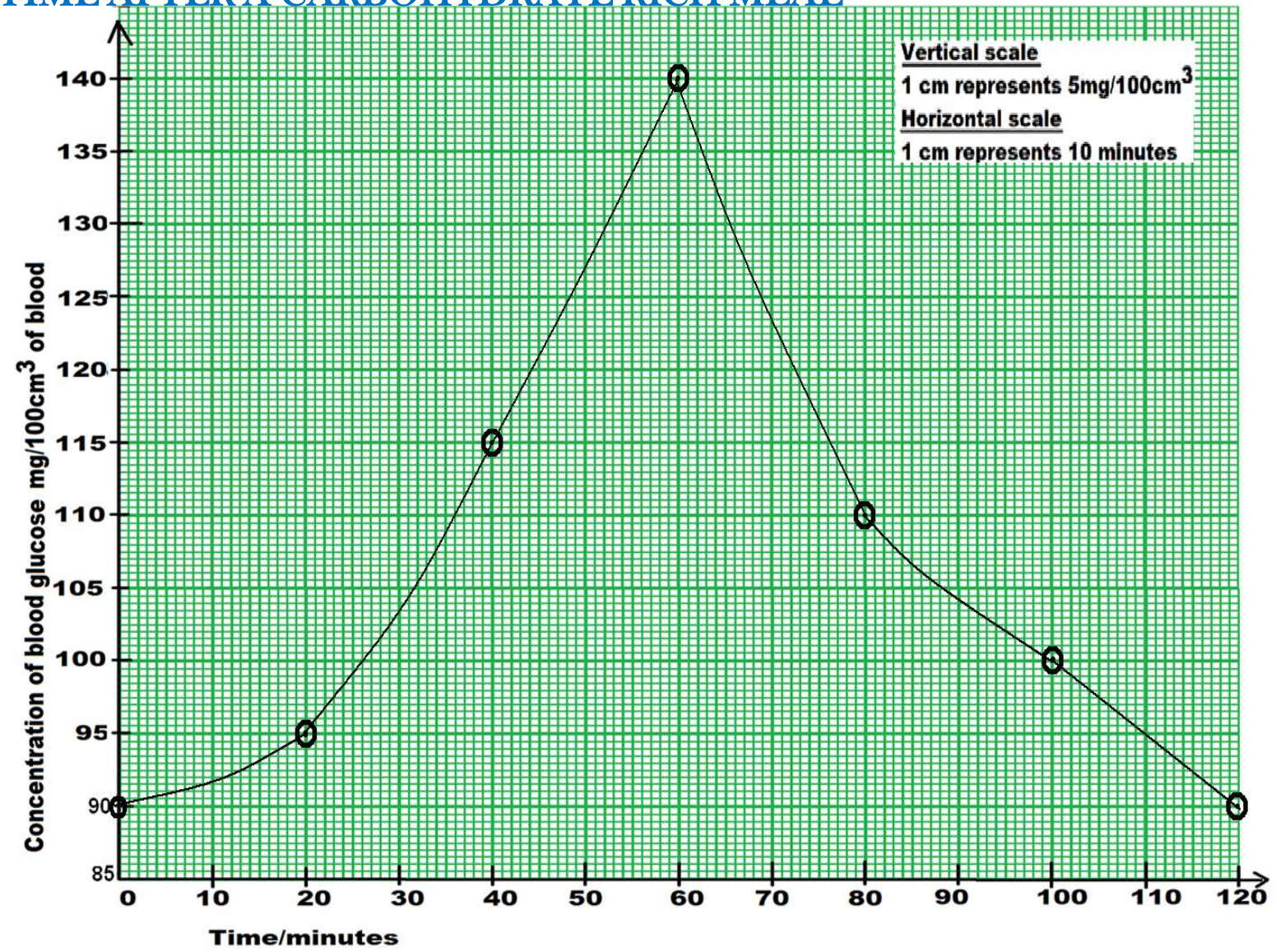
From 20 to 25 hours bacterial population increases gradually due to lack of enough food, water, oxygen and accumulation of fixed waste products.

From 25 to 40 hours, the population remains constant because death rate equals birth rate, this may be due to shortage of food and accumulation of waste products. The population at this point is said to have reached the carrying capacity.

From 40 to 50 hours, population of bacteria reduces because of shortage of food, shortage of oxygen and accumulation of toxic waste products which makes death more than birth rate.

DESCRIPTION AND EXPLANATION FOR CHANGES IN BLOOD GLUCOSE AFTER A MEAL

A GRAPH SHOWING VARIATION IN THE CONCENTRATION OF BLOOD GLUCOSE WITH TIME AFTER A CARBOHYDRATE RICH MEAL



Description

From 0 to 20 minutes blood glucose concentration increases gradually
From 20 to 60 minutes blood glucose concentration increases rapidly
From 60 to 80 minutes blood glucose concentration decreases rapidly
From 80 to 120 minutes blood glucose concentration decreases gradually

From 0 to 20 minutes blood glucose concentration increases gradually

From 20 to 60 minutes blood glucose concentration increases rapidly because carbohydrates are converted to glucose by enzymes in the alimentary canal and then glucose is absorbed into the blood stream from the ileum.

From 60 to 80 minutes blood glucose concentration decreases rapidly

From 80 to 120 minutes blood glucose decreases gradually because increase in blood glucose causes the pancreas to secrete insulin hormone which causes conversion of glucose to glycogen, glucose to fats and proteins and then glucose to carbon dioxide, water and energy.

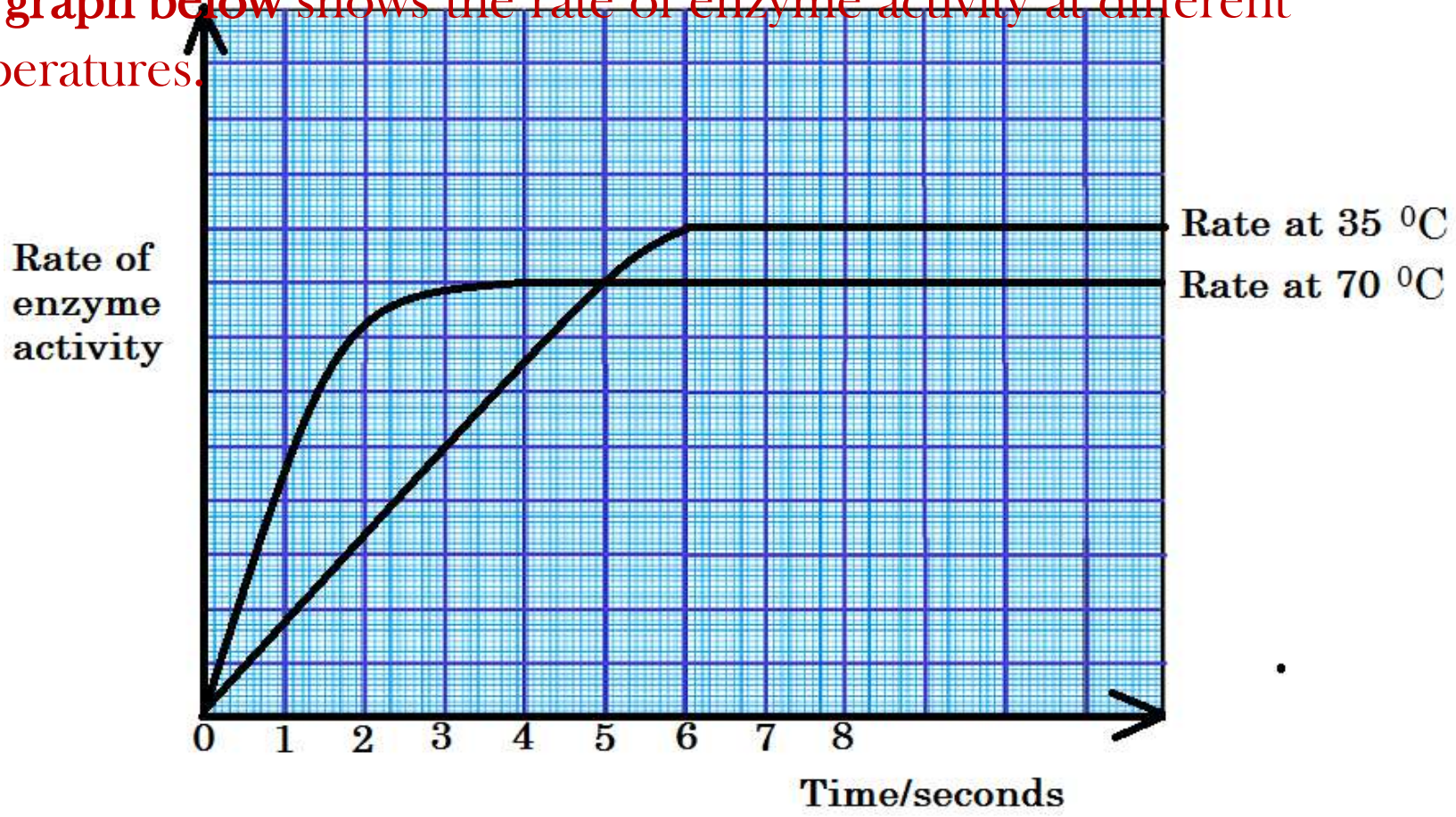
Comparison of graphs

Graphs are compared when two or more independent variables are plotted on the Y-axis. When two graphs are being compared **similarities** and **differences** between the variable are stated.

Example 3

Comparing two dependent variables (results)

The graph below shows the rate of enzyme activity at different temperatures.



Question

5.Compare the rate of enzyme activity at 35°C and 70°C

6.Explain the graph at 70°C

Solutions

Differences between the rate at 35°C and 70°C

From 0 to 3 seconds, rate at 70°c increases more rapidly than rate at 35°C

From 3 to 4 seconds, rate at 70°C increases gradually while rate at 35°C increases rapidly.

From 5 to 6 seconds, rate at 70°c is constant while rate at 35°C increases gradually.

From 6 to 8 seconds rate at 35°C is higher than rate at 70°c

Rate at 70°C peaks faster than the rate 35°C

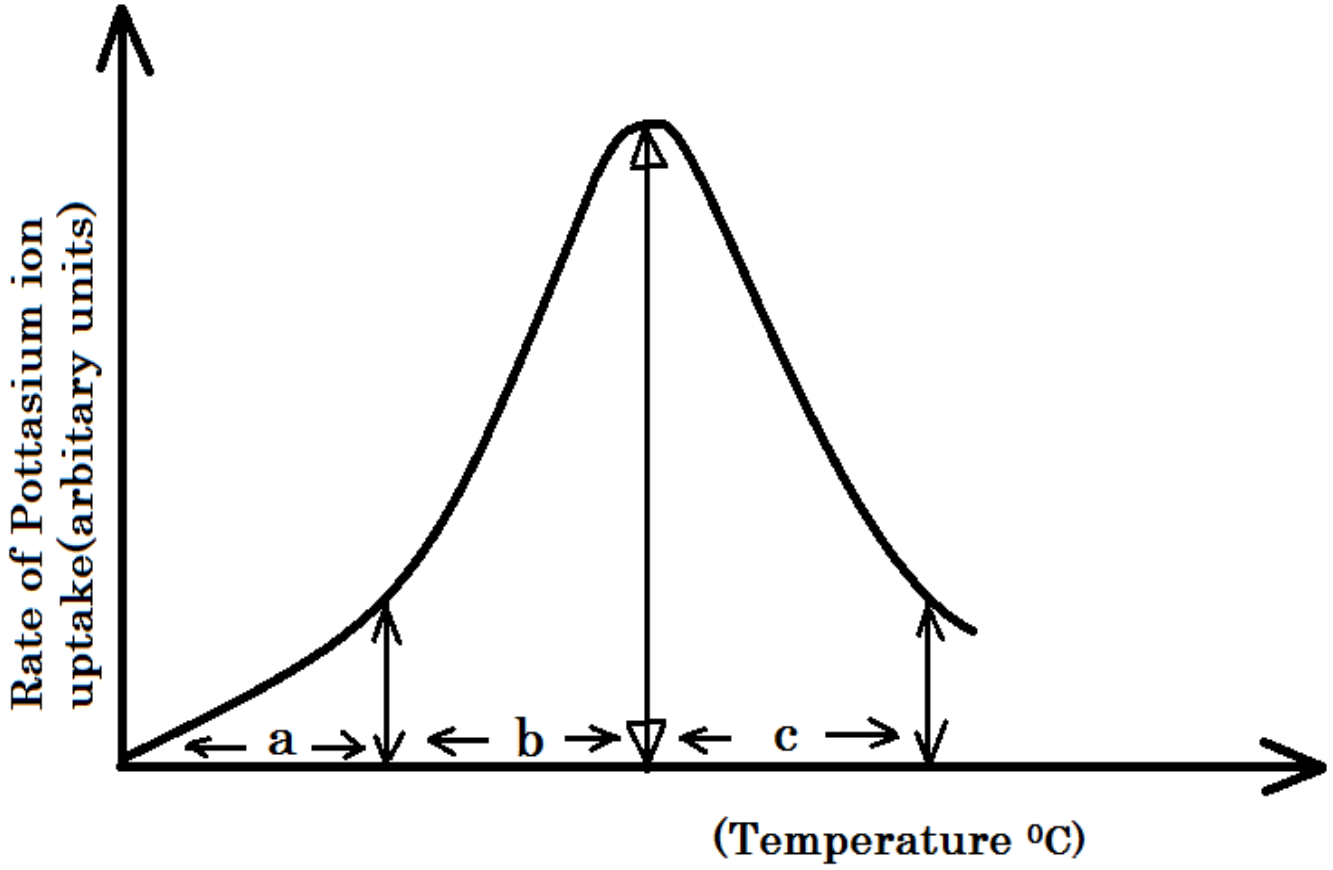
Similarities between the graphs

Both increase rapidly from one to three seconds

Both have the same rate at five seconds

Both reach the peak and become constant.

The graph below shows the effect of temperature on the rate of potassium ion uptake by the roots of a certain plant.



Describe the graph and explain the graph.

Hint

The independent variable is temperature while the dependent variable is the rate of potassium ion uptake.

The independent variable has no values so a general description of it is given.

3. Description of the graph

Increase in temperature leads to gradual increase in the rate of potassium ion uptake followed by rapid increase up to a maximum and then the rate of decreases rapidly with further increase in temperature

4. Explanation of the graph

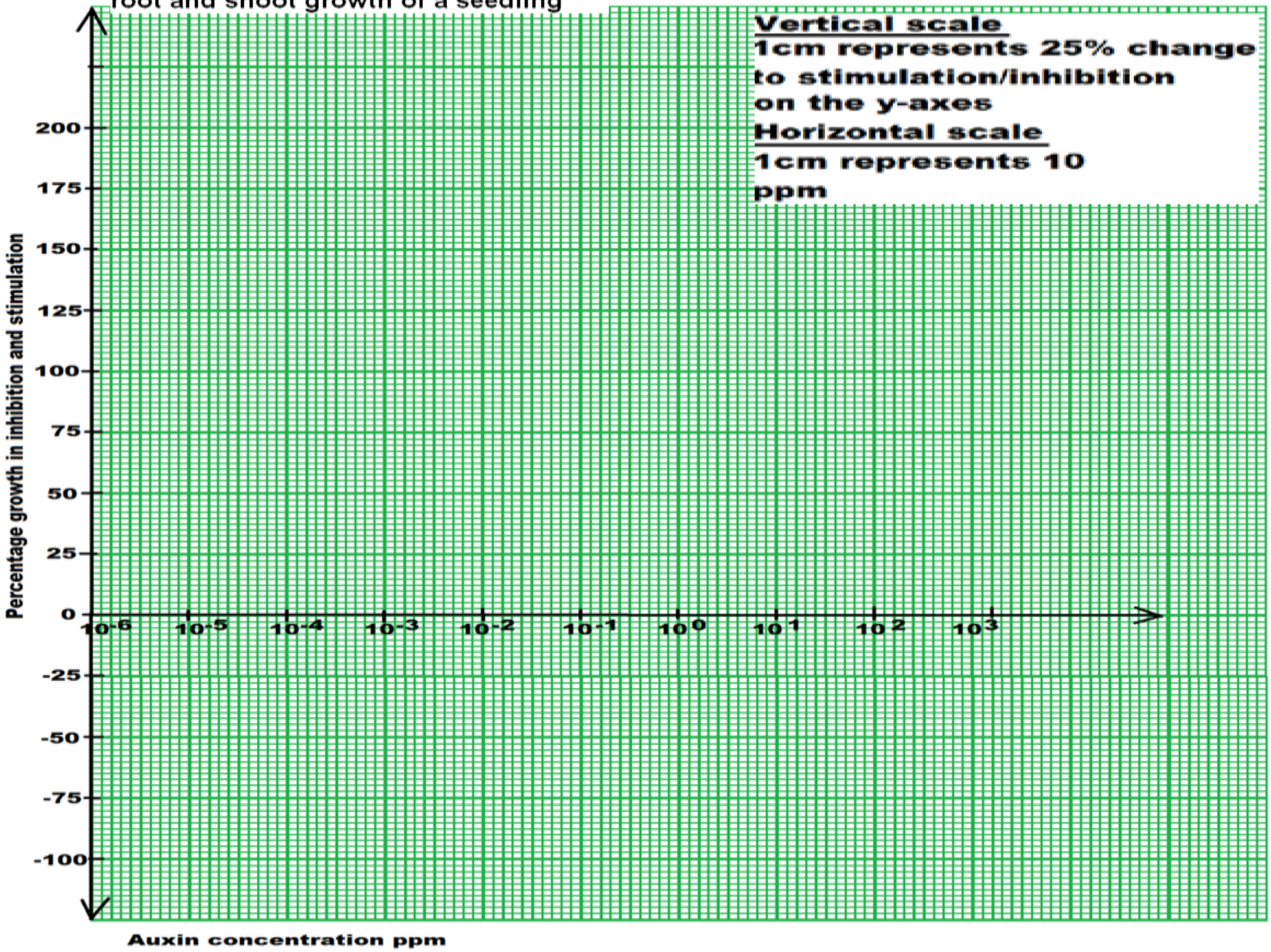
Initially increase in temperature leads to increase in the rate of potassium ion uptake by roots because increase in temperature causes an increase in the rate of respiration. This leads to production of more energy (ATP) required for absorption of potassium ions into the by active transport. Increase in temperature beyond a certain level leads to rapid decrease in the rate of potassium ion uptake because high temperature denatures enzymes involved in respiration. This reduces the rate of respiration and production of energy (ATP) and therefore reduces the rate of active transport of potassium ions into the root cells. High temperatures also denature proteins involved in active transport which blocks channels for passage of potassium ions.

A biologist carried out an experiment to determine how auxins affect root and shoot growth. Different amounts of auxins in (ppm) were supplied to roots and shoots. The resulting growth responses of both shoot and roots are as follows in the table below (negative values are as a result of growth inhibition, while positive values are as result of growth stimulation).

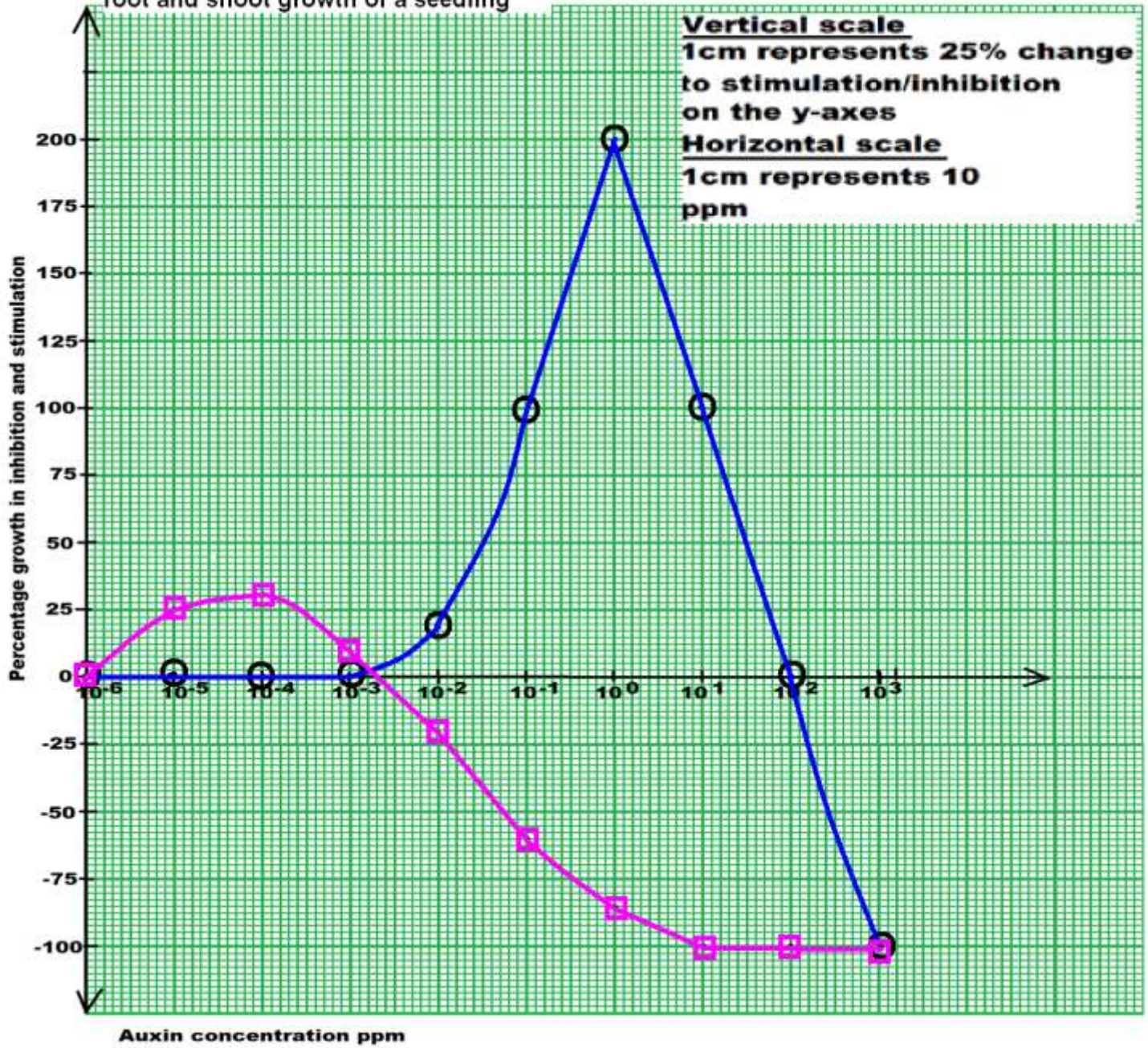
Concentration of Auxins/ppm	10^{-6}	10^{-5}	10^{-4}	10^{-3}	10^{-2}	10^{-1}	10^{0}	10^{1}	10^{2}	10^{3}
Percentage growth response of shoots	0	0	0	0	20	100	200	100	0	-75
Percentage growth response of roots	0	25	30	10	-20	-60	-80	-100	-100	-100

Using an appropriate scale(s) and on the same graph, draw graphs to represent the percentage growth response of shoots and roots with varying auxin concentration.
(6 $^{1}/_{2}$ marks)

A graph showing the effect of auxin concentration on root and shoot growth of a seedling

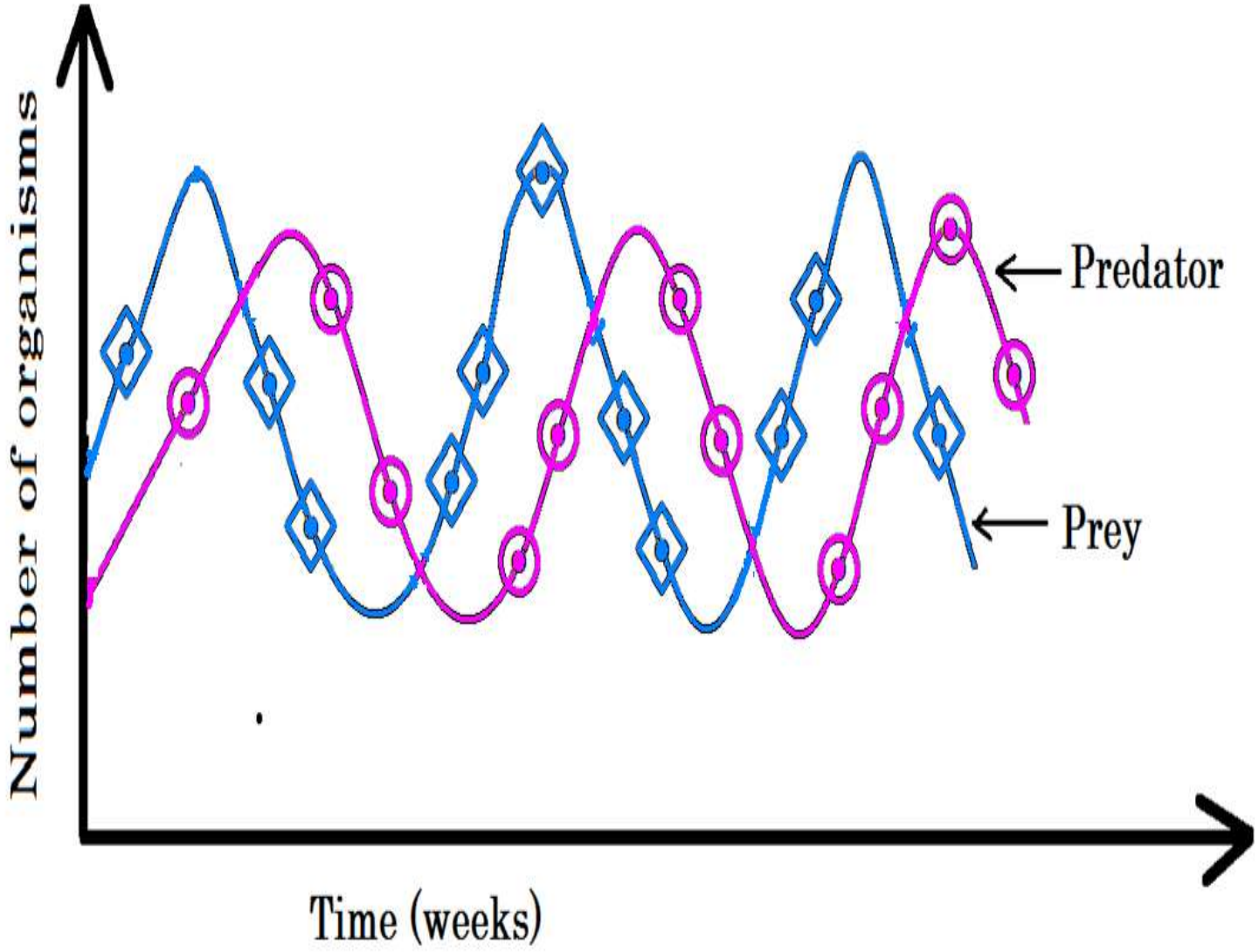


A graph showing the effect of auxin concentration on root and shoot growth of a seedling



Example 8.

Graphs showing the relationship between predator and prey in a certain habitat.



Question 24: Describe the relationship between the two organisms.
Question 25: Explain how the number of organisms changes in time.
Question 26: Suppose the prey is a rat, suggest a suitable method that you would employ to estimate its population.
Question 27: Outline the assumptions and precautions taken during the use of this method.
Question 28: What is the importance of predators in the ecosystem?
Question 29: How are prey adapted to avoid predators?
Question 30: How are predators adapted to catching prey?

Solutions:

Question 24: At first the population of the prey is higher than that of the predator. The population of the prey increases as that of the predator also increases. The population of the prey reaches maximum before that of the predator. The population of the prey then decreases followed by decrease in the population of the predator.

Question 25: The population of the prey is higher than that of the predator at first because the predator feeds on the prey so the prey is at a lower trophic level while the predator is at higher trophic level. As the population of the prey increases, that of the predator also increases due to the increased availability of foods. The population of the prey reaches maximum earlier than that of the prey because they reproduce faster and mature earlier than the predator. The population of the predator decreases as that of the prey also decreases due to lack of food.

Question 26: I would use the capture, mark, recapture method which involves the following steps.

- Identify the habitat
- Set traps to capture the rats
- Count and mark the captured rats and release them back to the habitat.
- Allow some time to pass and set traps again to capture the rats.
- Count the number of marked and unmarked rats in the second sample.
- Then I would estimate the population using the formula

$$\frac{F1 \times F2}{F3}$$

F1 represents number of marked rats in the first sample

F2 represents number of rats in the second sample(both marked and unmarked)

F3 represents number of marked rats in the second sample.

Question 27:

Assumptions:

- No deaths of rats
- No migration of rats from other habitats into the habitat
- No movement of rats away from the habitat.
- Uniform mixing of marked rats with other rats in the habitat

Precautions:

- Marking should not harm the rats.
- Markings should not make the rats more visible to the predators
- Markings should not impair the ability of rats to move freely.
- Sufficient time should be allowed for the marked and unmarked rats to mix freely.
- There should be no human interference.

END