S.5 BIOLOGY DISCUSSION GUIDE

1. An experiment was carried out to investigate the effect on growth of rats on including milk in their diet. Two groups, **A** and **B**, each consisting of eight young rats fed on a synthetic diet (mice pellets) of purified casein, sucrose, inorganic salts and water.

Group **A** received a supplement of 30cm^3 of milk per day for the first 18days then received no further milk.

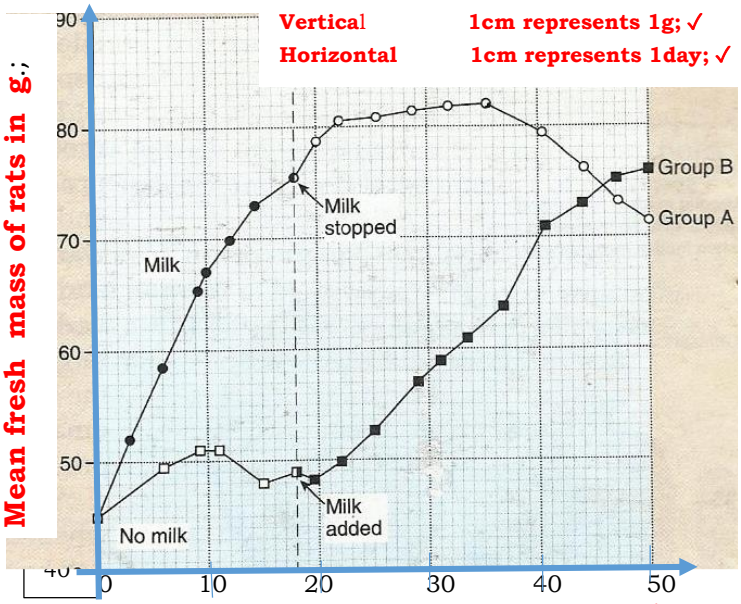
Group **B** was given no milk for the first 18days, then received a supplement of 3cm^3 of milk per day.

The Table below gives the mean fresh mass of the two groups of rats recorded regularly during the investigation.

Time(days)	0	5	10	15	20	25	30	35	40	45	50
Mean fresh mass of group **A** rats	45	57	67	71	79	81	82	82	80	75	75
Mean fresh mass of group **B** rats	45	48	51	48	48	53	58	65	70	73	76

(a). Using the same axes, represent the above data by plotting suitable graphs.

A graph of mean fresh mass of two groups of rats varying with time; ✓ (10marks)



Vertical **1cm represents 1g;** ✓

Horizontal **1cm represents 1day;** ✓

(b) From the graph, calculate the average growth rate of rats from the two groups **A** and **B** at;

(i).0-10th day for group **A**. (2marks)

Average growth rate= $\frac{\text{change in mean mass}}{\text{change in time}}$; ✓

$=\frac{(67-45)}{(10-0)}$; ✓ $\frac{22}{10}$; ✓

=2.2 g/day; ✓ @ ½ mk

(ii).20th- 50th day for group B (2marks)

Average growth rate $=\frac{(76-48)}{(50-20)}$; ✓ $\frac{28}{30}$; ✓

=0.93g/day; ✓

(c) (i). Compare the changes in the mean mass of both groups of rats during the whole experiment. (10marks)

Similarities.

-When no milk is given, mean mass of both group of rats increases; ✓ **and decreases;** ✓

-Both groups of rats have the same mean mass at day 0; ✓ **and day 46;** ✓

-When milk is added, mean mass of both groups of rats increases; ✓

-From 0 to 9th day; ✓ **and 20th day to 35.5th day;** ✓ **mean mass of both groups of rats increases;** ✓

--From 15th day to 18th day; ✓ **mean mass of both groups of rats increases gradually;** ✓

Differences.

Group A rats	**Group B rats**
From 46th day to 50th day, mean mass is lower ✓	**From 46th day to 50th day, mean mass is higher**
From 0 to 9th day, mean mass increases rapidly ✓	**From 0 to 9th day, mean mass increases gradually**
From 9th day to 11th day , mean mass increases rapidly ✓	**From 9th day to 11th day, mean mass remains constant**
From 11th day to 15th day, and 18th to 20th day, mean mass increases rapidly ✓	**From 11th day to 15th day, and 18th day to 20th day, mean mass decreases gradually**
From 35.5th day to 40.5th day, mean mass decreased rapidly. ✓	**From 35.5th day to 40.5th day, mean mass increased rapidly.**
Attains a maximum mean mass on day 36/earlier ✓	**Attains a maximum mean mass on day 50/later;**
From 40.5th day to 50th day, mean mass decreased gradually. ✓	**From 40.5th day to 50th day, mean mass increased gradually.**
From 0 to 46th day, mean mass is higher ✓	**From 0 to 46th day, mean mass is lower**
Grows faster when milk is added	**Grows slower when milk is added**

ii). Explain the changes in the mean mass of both groups of rats in c(i) above. (8marks)

Mean mass of both groups of rats increases rapidly when they received milk because milk contains lactose sugar; ✓ oxidized to provide energy; ✓ required for growth; ✓ milk provides extra proteins; ✓ for growth; ✓ extra calcium; ✓ for bone and teeth formation; ✓ Milk also contains vitamins for proper growth; ✓

Mean mass of both groups of rats decreased gradually when milk was stopped because the lactose, vitamins and extra proteins needed for growth of different tissue were lacking; ✓ @1mark

(d).Describe,

(i).the **physiological significance** of including mineral salt like calcium in the diet of rats? (5marks)

Calcium ions activate the troponin protein; ✓ thereby allowing it displace tropomyosin; ✓ from the myosin bridge binding site on the thin actin filament; ✓ myosin bridge thus attaches to the thin actin filament; ✓ forming actomyosin; ✓during muscle contraction. ✓ Rej For muscle contraction alone

Concentration of calcium ions when sufficiently high; ✓ activates ATP synthetase enzyme; ✓that catalyse ATP hydrolysis; ✓ providing energy for muscle contraction; ✓

Calcium ions together with thromboplastin and vitamin K, convert the inactive prothrombin to thrombin; ✓ during blood clotting; ✓ Rej For blood clotting alone.

Formation of strong bones and teeth; ✓

Calcium ions stimulate the release of neurotransmitter substances; ✓by synaptic vesicles into the synaptic cleft; ✓ during impulse transmission along a synapse; ✓ Rej. For nerve activity alone

@ ½ mark.

(ii) how the rats were able to deal with excess proteins in their diet. (3marks)

Excess proteins are deaminated in the liver; ✓ forming urea; ✓excreted in urine; ✓

END