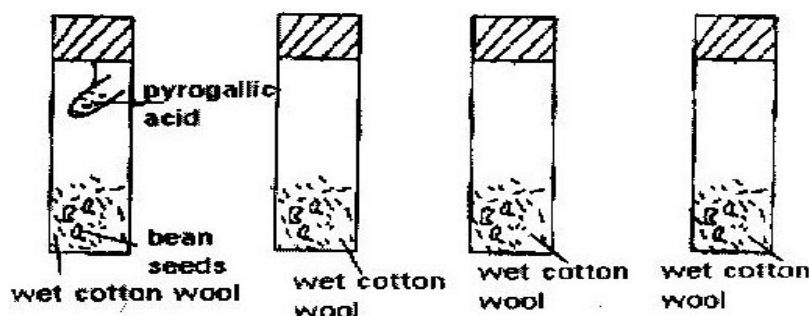


# GROWTH AND DEVELOPMENT

## 1. 1989 Q9 P1

## 2. 1990 Q11 P1

In an experiment, a group of students set up four glass jars as shown in the diagram below. Jar A, B and C were maintained at 25 for 7 days, while jar D was maintained at 0 for the same period of time.



- What was this set up supposed to investigate?
- Why was pyrogalllic acid included in glass jar A?
- Explain why glass jar C and D were included in the experiment?
- What result would you expect in glass jar A and B at the end of the experiment?
- State two artificial ways of breaking seed dormancy.

## 3. 1990 Q16 P1

- Describe the secondary thickening in flowering plants.
- Describe one method, which can be used to measure the average growth rate of a single leaf plant.

## 4. 1992 Q15 P1

Removal of the apical bud from the shrub is a practice that results in the development of the lateral buds which later form the branches.

- Give reasons for the development of the lateral branches after the removal of the Apical bud
- Suggest one application of this practice?
- What is the importance of this practice?

## 5. 1993 Q16 P1

In an experiment some germination seeds were placed in a large airtight flask left for four days.

- Suggest the expected changes in the composition of gases in the flask on the fifth Day.
- Give your reasons for your answer in (a) above.
- Name two factors that cause dormancy in seeds

## 6. 1993 Q17 P1

In an experiment, maize grains were soaked in different concentrations of solutions X for 24 hours. In the control experiment the seeds were soaked in distilled water for the same

time. The seeds were placed on moist cotton wool in different Petri dishes. They germinated and grew for ten days. After which the percent germination was determined.

The average lengths of shoots and roots were also determined. The results were as shown in the tables A and B below.

| Concentration of days Solution X(%) | % germination | Growth of seedlings after 10 (average length in mm) |       |
|-------------------------------------|---------------|-----------------------------------------------------|-------|
|                                     |               | Shoots                                              | roots |
| 80                                  | 33            | 3                                                   | 8     |
| 60                                  | 52            | 5                                                   | 9     |
| 40                                  | 95            | 7                                                   | 17    |
| 20                                  | 87            | 16                                                  | 38    |
| 10                                  | 92            | 28                                                  | 40    |
| Distilled water                     | 75            | 18                                                  | 64    |

Table B

| Concentration of days Solution X(%) | % germination | Growth of seedlings after 10 (average length in mm) |       |
|-------------------------------------|---------------|-----------------------------------------------------|-------|
|                                     |               | Shoots                                              | roots |
| 80                                  | 0             | 0                                                   | 0     |
| 60                                  | 0             | 0                                                   | 0     |
| 40                                  | 12            | 3                                                   | 4     |
| 20                                  | 42            | 4                                                   | 5     |
| 10                                  | 90            | 12                                                  | 42    |
| Distilled water                     | 95            | 29                                                  | 63    |

- What was the effect of solution X on
  - Germination of the maize grains
  - Growth maize seedlings
- Compare the growth of seedlings whose grains were previously soaked in 80% of Solution Y
- Explain how percent germination in this experiment was determined.
- From the results in tables A and B what other conclusions can be drawn about solution X and Y?
- Other than moisture and solution X and Y what other conditions were necessary for germination of the maize grains?
- State two ways in which indoleacetic acid (IAA) influences growth in plants.

**7. 1994 Q7P1**

Account for loss in dry weight of cotyledons in a germinating bean seed.

**8. 1994 Q10 P1**

What is the effect of gibberellins on shoots of plants?

**9. 1994 Q 18 P1**

In an experiment to investigate the effect of heat on germination of seeds, eleven bags each containing 50 bean seeds was placed in a water bath maintained at 90°. After 2 minutes, a bag was removed and the seeds contained were planted. The number that germinated was recorded.

The procedure used for the beans was repeated for Acacia seeds.  
The results obtained were as shown in the table below.

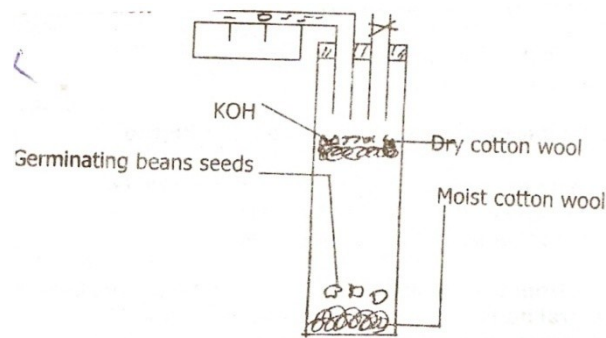
**Number of seeds that germinated**

| Time (min) | Beans seeds | Acacia seeds |
|------------|-------------|--------------|
| 0          | 50          | 0            |
| 2          | 50          | 0            |
| 4          | 46          | 1            |
| 6          | 35          | 2            |
| 8          | 10          | 28           |
| 10         | 1           | 36           |
| 12         | 0           | 41           |
| 14         | 0           | 44           |
| 16         | 0           | 47           |
| 18         | 0           | 48           |
| 20         | 0           | 50           |

- (a) Using a suitable scale and on the same axes draw graphs of time in hot water against number of seeds that germinated for each plant. Use the horizontal axis for the seeds that germinated.
- (b) (i) After how many minutes would you expect 50% of acacia seeds exposed to the hot to germinate?
- (ii) What was the minimum number of minutes after exposure of beans to hot water was there no germination?
- (c) From the graphs, which one of the two types of seeds was more sensitive to heat influence on germination? Give reasons for your answer.
- (d) Explain why the ability for the
- (i) Beans seeds to germinate declined with time of exposure to heat
- (ii) Acacia seeds to germinate improved with time of exposure to heat.
- (e) What results would be expected if the temperature of water was maintained at 100°C.....
- 5°C.....

**10. 1995 Q12 P1**

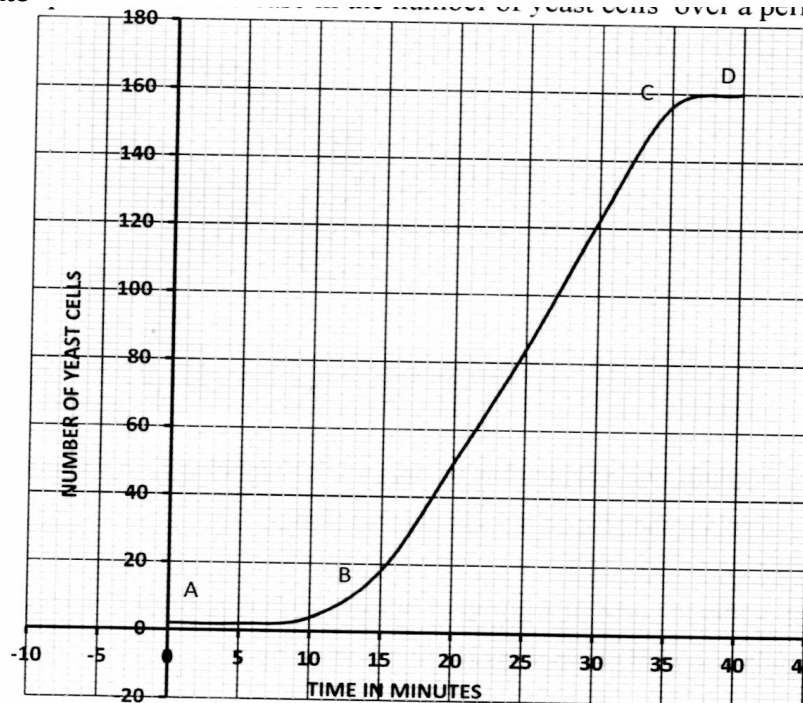
The diagram below show an experiment set up to investigate aspect germination



- Why is potassium hydroxide pellets used in this experiment? (1 mark)
- Why is moist cotton wool used in this experiment? (1 mark)
- By means of an arrow indicate on the diagram the direction in which the red dye would move during the experiment. (1 mark)
  - Give reasons for your answer in (c) (i) above (3 marks)

#### 11. 1995 Q15 P1

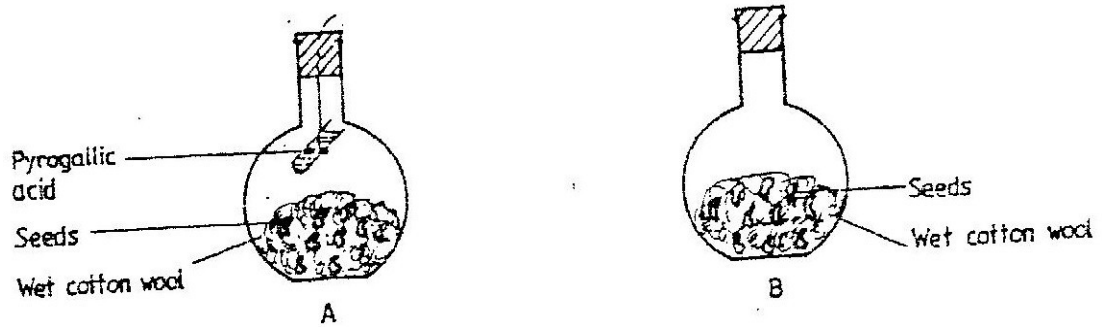
The graph below represents the increase in the number of yeast cells over a period of 48 minutes



- Name the type of curve shown (1 mark)
- Determine the number of yeast cells after 26 minutes (1 mark)
- Work out the rate of cell division between 24 and 28 minutes (2 marks)
- After how long was the population of yeast cells 128? (1 mark)
- Name the phase of the curve labelled
  - A to B
  - B to C
- Give reasons for the shape of the graph between points C and D (3marks)
- State five factors, which would cause human population growth to assume the shape of the graph curve between points B and C (5 marks)

**12. 1996 Q10 P1**

A student set up an experiment as shown in the diagrams below

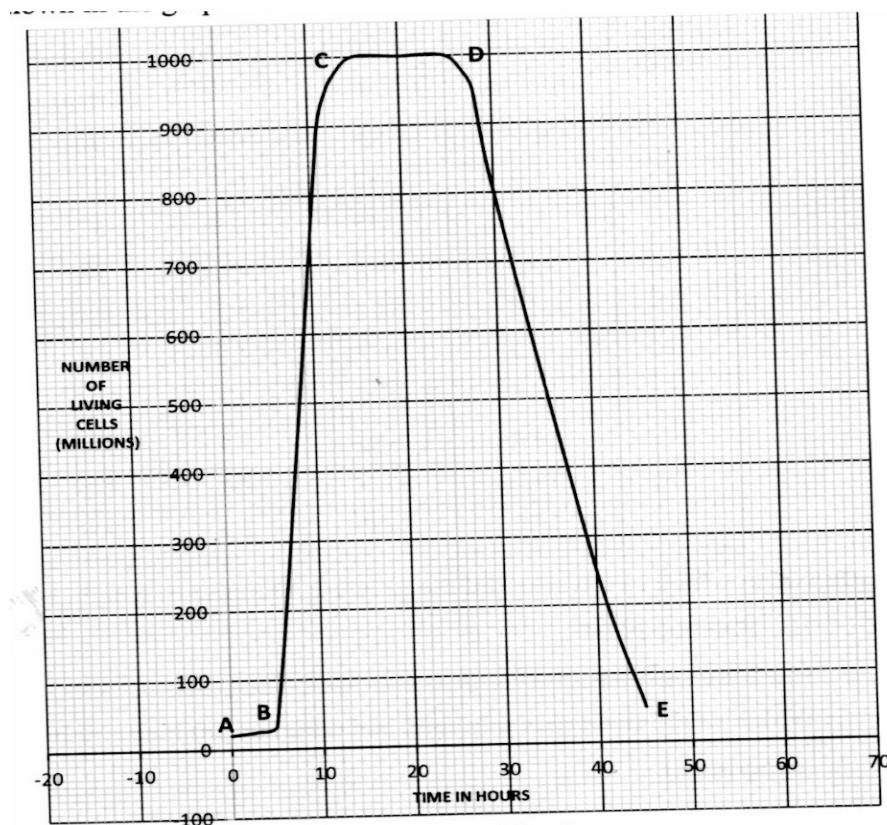


The set up was at room temperature for a week

- (a) What was the aim of the experiment? (1 mark)  
 (b) What would be the expected results at the end of the experiment (2 marks)

**13. 1996 Q20 P1**

A culture of bacteria was incubated in nutrient agar at 35°C. Samples were taken at intervals in order to estimate the number of bacteria in the population. The data obtained is shown in the graph below.



- (a) When was the pollution of bacteria 350 million (2 marks)  
 (b) Account for the shape of the graph between  
 (i) A and B (1 mark)  
 (ii) B and C (3 marks)  
 (iii) C and D (2 marks)

- (c) Give three reasons for the shape of the curve between D and E (3 marks)
- (d) (i) Suggest what would happen to the population of the bacteria if the temperature was lowered to 0° after incubating for 12 hours. (1 mark)
- (ii) Give a reason for your answer in (d) (i) above (1 mark)
- (e) Give three reasons why it is important to control human population growth rate in Kenya? (3 marks)

**14. 1997 Q18 P1**

An experiment was carried out to determine the growth rates of bamboo and a variety of maize plants in two adjacent plots. The average height and average dry weight of plants from the two populations were determined over a period of twenty weeks. The data is as shown in the table below.

|                     | <b>Bamboo</b>                  |                               | <b>Maize</b>                   |                               |
|---------------------|--------------------------------|-------------------------------|--------------------------------|-------------------------------|
| <b>Age in weeks</b> | <b>Average height (Metres)</b> | <b>Average weight (Grams)</b> | <b>Average height (Metres)</b> | <b>Average weight (Grams)</b> |
| 2                   | 1.3                            | 52                            | 0.3                            | 20                            |
| 4                   | 4.0                            | 182                           | 0.5                            | 29                            |
| 6                   | 8.2                            | 445                           | 0.8                            | 57                            |
| 8                   | 12.1                           | 682                           | 1.2                            | 78                            |
| 10                  | 13.9                           | 801                           | 1.7                            | 172                           |
| 12                  | 14.1                           | 957                           | 1.9                            | 420                           |
| 14                  | 14.3                           | 1025                          | 2.1                            | 704                           |
| 16                  | 14.4                           | 1062                          | 2.1                            | 895                           |
| 18                  | 14.6                           | 1127                          | 2.1                            | 926                           |
| 20                  | 14.6                           | 1229                          | 2.1                            | 908                           |

- (a) Between which two weeks did the greatest increase in weight occur in  
 (i) Bamboo plants (2 marks)  
 (ii) Maize plants
- (b) (i) Which of the two types of plants had a higher productivity by the end of the Experiment (2 marks)  
 (ii) Give a reason for your answer in (b) (i) above (1 mark)
- (c) Between weeks 14 and 18, the average height of the maize plants remained constant while average dry weight increased.  
 Explain this observation (2 marks)
- (d) Suggest how the change in the average dry weight bamboo and maize Plants would have been at week 22 if the experiment was continued. (2 marks)
- (e) Why was it appropriate for this experiment to use  
 (i) Dry weight instead of fresh weight  
 (ii) Weight and height (4 marks)

(f) Describe how the average height and weight of the plants were determined in this experiment. (4 marks)

(g) Give a reason why secondary thickening does not occur in bamboo and maize plants (2 marks)

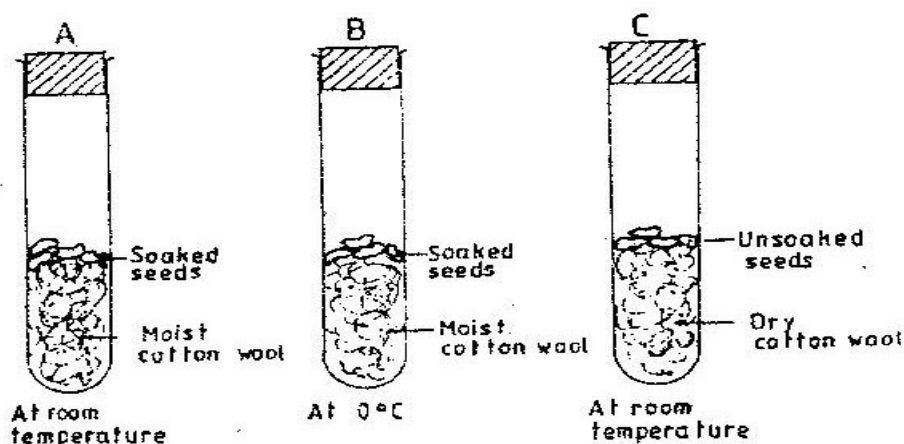
15. 1999 Q12

16. 2000 Q9 P1

State two advantages of metamorphosis to the life of insects. (2 marks)

17. 2001 Q15 P1

The diagram below represents a set up to investigate the conditions necessary for seed germination.



The set up was left for 7 days

(a) What conditions were being investigated in the experiment? (2 marks)

(b) State three reasons for soaking seeds in set ups A and B (3 marks)

(c) What were the expected results after seven days? (3 marks)

18. 2002 Q4 P1

During germination and early growth, the dry weight of the endosperm decreases while that of the embryo increases. Explain. (2 marks)

19. 2002 Q19 P1

Describe the role of hormones in the growth and development of plants. (20 marks)

20. 2003 Q15(c) P1

State four applications of plant hormones in agriculture. (2 marks)

21. 2004 Q17 P1

During germination and growth of a cereal, the dry weight of endosperm, the embryo and total dry weight were determined at two – day intervals. The results are shown in the table below.

| Time after planting (days) | Dry weight of endosperm | Dry weight of embryo (mg) | Total dry weight (mg) |
|----------------------------|-------------------------|---------------------------|-----------------------|
| 0                          | 43                      | 2                         | 45                    |
| 2                          | 40                      | 2                         | 42                    |
| 4                          | 33                      | 7                         | 40                    |
| 6                          | 20                      | 17                        | 37                    |
| 8                          | 10                      | 25                        | 35                    |
| 10                         | 6                       | 33                        | 39                    |

- Using the same axes, draw graphs of dry weight of endosperm, embryo and the total dry weight against time (7 marks)
- What is the total dry weight on day 5?
- Account for:
  - Decrease in dry weight of endosperm from day 0 to 10 (2 marks)
  - Increase in dry weight of embryo from day 0 to day 10 (2 marks)
  - Decrease in total dry weight from day 0 to day 8 (2 marks)
  - Increase in total dry weight after day 8 (1 mark)
- Accounting for dormancy.
  - Within a seed
  - Outside the seed
- Give two characteristics of meristematic cells (2 marks)

**22. 2005 Q8 P1**

Name three factors in seeds that cause dormancy. (3 marks)

**23. 2006 Q14 P1**

- Distinguish between epigeal and hypogeal germination. (1 mark)
- Why is oxygen necessary in the germination of seeds? (2 marks)

**24. 2006 Q6 P2**

An experiment was carried out to investigate the effect of hormones on growth of lateral buds of three pea plants

The shoots were treated as follows:

Shoot A – Apical bud was removed.

Shoot B – Apical bud was removed and gibberellic acid placed on the cut shoot.

Shoot C – Apical bud was left intact.

The length of the branches developing from lateral buds were determined at regular intervals.

The results obtained are as shown in the table below.

| Time in days | Length of branches in millimeters |         |         |
|--------------|-----------------------------------|---------|---------|
|              | Shoot A                           | Shoot B | Shoot C |

|    |     |     |    |
|----|-----|-----|----|
| 0  | 3   | 3   | 3  |
| 2  | 10  | 12  | 3  |
| 4  | 28  | 48  | 8  |
| 6  | 50  | 9   | 14 |
| 8  | 80  | 120 | 20 |
| 10 | 118 | 152 | 26 |

- a) Using the same axes, draw graphs to show the lengths of branches against time. (8marks)
- b) i) What was the length of the branch in shoot B on the 7<sup>th</sup> day? (1mark)  
 ii) What would be the expected length of the branch developing from shoot A on the 11<sup>th</sup> day? (1mark)
- c) Account for the results Obtained in the experiment (6 marks)
- d) Why was shoot C included in the Experiment? (1 mark)
- e) What is the importance of gibberellic acid in agriculture? (1 mark)
- f) State two physiological processes that are brought about by the application of gibberellic acid on plants. (2marks)

**25. 2007 Q19 P1**

- (a) State two environmental conditions that can cause seed dormancy (2 marks)
- (b) Name the part of a bean that elongates to bring about epigeal germination (1 mark)

**26. 2007 Q6 P2**

In the experiment to determine the effect of ringing on the concentration of sugar in phloem a ring of bark from the stem of a tree was cut and removed. The amount of sugar in grammes per 16cm<sup>3</sup> piece of bark above the ring was measured over a 24 hour period. Sugar was also measured in the bark of a similar stem of a tree which was not ringed. The results are shown in the table below.

| Time of the day | Amount of sugar in grammes per 16cm <sup>3</sup> piece of bark |             |
|-----------------|----------------------------------------------------------------|-------------|
|                 | Normal stem                                                    | Ringed stem |
| 06 45           | 0.78                                                           | 0.78        |
| 09.45           | 0.80                                                           | 0.91        |
| 12.45           | 0.81                                                           | 0.01        |
| 15 45           | 0.80                                                           | 1.04        |
| 18.45           | 0.77                                                           | 1.00        |
| 21 45           | 0.73                                                           | 0.95        |
| 00 45           | 0.65                                                           | 0.88        |

- (a) Using the same axes, plot a graph of the amount of sugar against time (6 marks)
- (b) At what time was the amount of sugar highest in the
- (i) Ringed stem (1 mark)
- (ii) Normal stem? (1 mark)

- (c) How much sugar would be in the ringed stem if it was measured at 0345 hours? (1 mark)
- (d) Give reasons why there was sugar in the stems of both trees at 06 45 hours (2 marks)
- (e) Account for the shape of the graph for the tree with ringed stem between:  
 (i) 0645 hours and 1545 hours (3 marks)  
 (ii) 1545 hours and 0045 hours (2 marks)
- (f) Name the structures in phloem that are involved in the translocation of sugars (2 marks)
- (g) Other than sugars name two compounds that are translocated in phloem (2 marks)

**27. 2008 Q17 P1**

Account for the following phases of a sigmoid curve of a growth of an organism

- (a) Lag phase (1 mark)  
 (b) Plateau phase (1 mark)

**28. 2008 Q21 P1**

- (a) What is seed dormancy (1 mark)  
 (b) Name a growth inhibitor in seeds (1 mark)

**29. 2009 Q4 P1**

**30. 2009 Q11 P1**

**31. 2010 Q25 P1**

State **three** factors that contribute to the deceleration phase in the population curve of an organism (3 marks)

**32. 2010 Q30 P1**

What is meant by the apical dominance? (3 marks)

**33. 2011 Q29 P1**

State four reasons why water is significant in seed germination (4 marks)

**34. 2011 Q6a P2**

(a) An experiment was carried out to investigate the population of a certain micro-organism. Two Petri-dishes were used. Into the Petri – dish labeled M, 60cm<sup>3</sup> of a culture medium was placed while 30cm<sup>3</sup> of the same culture medium was placed in Petri-dish labeled N. Equal numbers of the micro-organisms were introduced in both Petri-dishes. The set-ups were then incubated at 35°C. The number of micro-organisms in each Petri-dish was determined at irregular intervals for a period of 60hours. The results were as shown in the table below.

|                                           |          |    |    |     |     |      |      |      |      |      |     |
|-------------------------------------------|----------|----|----|-----|-----|------|------|------|------|------|-----|
| <b>Relative number of micro-organisms</b> | <b>M</b> | 40 | 40 | 180 | 280 | 1200 | 1720 | 1600 | 1840 | 1560 | 600 |
| <b>N</b>                                  |          | 40 | 40 | 120 | 200 | 680  | 560  | 560  | 600  | 600  | 400 |
| <b>Time in hours</b>                      |          | 0  | 5  | 10  | 15  | 23   | 30   | 35   | 42   | 45   | 60  |

- (i) On the same axis, draw the graphs of relative number of micro-organisms against time on the grid provided. (7marks)
- (ii) After how many hours was the difference between the two populations greatest? (1mark)
- (iii) Work out the difference between the two populations at 50 hours. (2marks)
- (iv) With a reason state the effect on the population of micro-organisms in Petri – dish M if the temperature was raised at 60°C after 20 hours. (2marks)

**35. 2012 Q20 P1**

State three aspects that can be used to estimate growth in seedlings. (3 marks)

**36. 2012 Q25 P1**

State the role of the following hormones in the life cycle of insects:

Ecdysone hormone; .....

Juvenile hormone..... (2marks)

**37. 2013 Q19 P1**

State three factors in seeds that cause dormancy. (3 marks)

**38. 2013 Q27 P1**

(a) State two differences between complete and incomplete metamorphosis. (2 marks)

(b) State the importance of moulting to an insect. (1 mark)

**39. 2013 Q6 P2**

A scientist carried out an investigation to find out the population growth of mice under laboratory conditions. Twenty young mice were placed in a cage. The results obtained from the investigation were as shown in the table below.

|                       |    |    |    |     |     |     |     |     |     |
|-----------------------|----|----|----|-----|-----|-----|-----|-----|-----|
| <b>Time in months</b> | 0  | 2  | 4  | 6   | 8   | 10  | 12  | 16  | 18  |
| <b>Number of mice</b> | 20 | 20 | 65 | 115 | 310 | 455 | 450 | 145 | 160 |

- a) On the grid provided, draw a graph of the number of mice against time.
- b) account for the changes in mice population between
- 0 to 2 months (2 marks)
  - 2 to 6 months (2 marks)
  - 6 to 10 months (2 marks)
  - 10 to 12 months (2 marks)
- c) i) Between which two months was the population change greatest? (1 mark)
- ii) Calculate the rate of population change over the period in (c) (i) above. (2 marks)

- d) What change in population would be expected if the investigation was continued to the 19<sup>th</sup> month? (1 mark)
- e) To obtain the observed results state two variables that was kept constant during the investigation. (2 marks)

**40. 2014 Q2 P1**

- (a) What is meant by the term seed dormancy? (1 mark)
- (b) State **three** causes of seed dormancy (3 marks)

**41. 2014 Q6 P1**

State **three** roles of auxins in a plant stem . (3 marks)

## **GROWTH AND DEVELOPMENT MARKING SCHEME**

**1. 1989 Q9 P1**

- IAA/Auxins produced by terminal bud:probihits growth of lateral buds,when cut,the suppression ceases thus auxiliary buds sprout.

**1. 1990 Q11 P1**

- a) – Conditions necessary for the germination of seeds/to show that water Oxygen and warmth are needed for germination.
- b) –To absorb all oxygen from the jar
- c) –C- To show that water is needed for germination of seeds  
D- To show that warmth is needed for germination
- d) Jar A- Seeds would not germinate

- Jar B- Seeds would have germinated
- e) i) Scarification i.e scratching to make impermeable seed coat permeable
- ii) Vernalisation- Cold treatment e.g some species of wheat-Burning

**2. 1990 Q16 P1**

- a) Secondary thickening is facilitated by meristematic cells known as the cambium; located between the xylem and phloem in the vascular bundles
- The Cambium divides radially to form a ring of tissue; the xylem inside the ring and phloem outside the ring; cells of the cambium ring divide to form secondary phloem outside intervacular cambium divides to form secondary parenchyma thereby increasing the growth of medullary rays; more xylem is formed than phloem; thus pushing phloem and cambium ring outwards; the rate of secondary growth is dependent on seasons/rains; resulting in annual rings.
  - Cork Cambium tissue divides to form new cork/bark to accommodate increased growth on outside and secondary cortex on the inside

**b) EITHER**

Choose /identify a young leaf (just unfolded); use the same leaf throughout; measure (total) length of leaf. (Acc measurement of any part of the leaf); Record; Repeat at regular intervals; until no more change in length/constant length.

**OR**

Choose /identify a young leaf (just unfolded); use the same leaf throughout; Trace the outline on a graph paper and work out the area; Record; Repeat at regular intervals until constant area. average rate of growth is equal to total increase in area divided by the period of time taken to achieve final area

**3. 1992 Q15 P1**

- a. – Apical bud produces auxin/hormone/a growth substance which inhibits the development/growth of lateral shoots/buds/apical dominance; removal of terminal buds cause the growth/development and sprouting of lateral buds.
- b. The pruning of coffee/tea/hedge etc for pruning only
- c. More yield/Production/Bushy edge  
Acc. More bushy or thicker if it is above hedge

**4. 1993 Q16 P1**

- a)- Low  $O_2$ /Low in  $O_2$ /all used up; and increase in  $O_2$ /high  $CO_2$ /A lot of  $CO_2$ ; NB. Element of change.
- b) – Germinating seeds respire/use  $O_2$  and release  $CO_2$  only
- c) – Absence of light; impermeability of seed coat to water; under-developed embryo/immature embryo; lack of growth hormones/enzymes
- Presence of inhibitors

**5. 1993 Q17 P1**

- a) i) – High or Conc. retards/slow down/inhibits germination; while low conc has less inhibition/promotes germination

ii) Higher conc of solution X retards/slow down/inhibits growth in roots and shoots while low conc has less inhibitory effect/promotes/favours growth  
In roots and shoots. But growth is greater in roots at all concentrations  
Acc. The higher the concentrations of solution X the lower the growth of seedlings

b) At 80% no growth (in shoots and roots); At 105 the shoots have grown upto 12mm; while the roots grow up to 42mm; OR at 10% Y has a higher stimulating effect on growth of roots than shoots; At 80% Y has no stimulating effect on growth of roots or shoots )

c)  $\frac{\text{No germinated}}{\text{Original number}} \times 100$

d) At lower concentrations there was a greater rise in both germination and growth in Y than X; However both X and Y are inhibitors of growth and germination/ at high concentration Y inhibits both germination and growth more than X.

e) – Air/oxygen; warmth/optimum temperature/suitable temperature. Rej Heat  
f) – Promotes cell division; cell elongation; development of abscission layer; growth of ovaries into fruits=/causes parthenocarpy; inhibits growth of lateral buds/promotes apical dominance/promotes growth of adventitious roots/lateral roots

**6. 1994 Q7 P1**

– Food stored is used (mobilized) up for respiration and growth  
(Respiration =  $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$ )  
the idea of respiration must clearly come up.

**7. 1994 Q10 P1**

– They promote all/intermodal/elongation/rapid cell division  
– Promote fruit formation without fertilization/Parthenocarpy

**8. 1994 Q18 P1**

a) i) 7-8 minutes

ii) 11-12 minutes

b) – Bean seeds

Because the curve is steeper than that of acacia; more seeds germinating on exposure to hot water for a short time. (OWTTE)

c) i) Destruction by heat of the embryo and enzymes/denaturing of enzymes.

ii) Acacia seeds were dormant, heat broke dormancy; the more the heat the better the offer.

d) i) At  $100^{\circ}\text{C}$  (comparatively) fewer/no bean seeds will germinate but more/all acacia seeds will germinate.

ii) At  $5^{\circ}\text{C}$ , no acacia seeds will germinate (comparatively) all/most  $\frac{50}{100}\%$  will germinate

9. **1995 Q12 P1**
- (a) To absorb CO<sub>2</sub>; reacts with CO<sub>2</sub>
  - (b) To provide moisture to generating seeds. Accept water for moisture
  - (c) (ii) Oxygen in the tube is taken up for germination CO absorbed by higher pressure outside tube
10. **1995 Q15 P1**
- a. - Sigmoid of the curve shown
  - b. - 92 acc. 93
  - c.  $\frac{110 - 78}{4} = 8.0$  (cells/ min)
  - d. 31.5 (mins)
  - e. (i) A to B Lag phase / slow growth phase  
(ii) B to C Exponential /log/rapid growth phase
  - f. Slow/ reduced growth due to limiting environmental factors ( Accept any example) rate of multiplication is almost the same as the death rate, Acc: few cells are still dividing Rej. Growth for multiplication but acc. Reproduction.
  - g. – Low death rate/ low mortality;
    - Rej. Decrease in death rate/ reduced death rate
    - High birth rate/ high fertility acc. Increased birth rate
    - Improved medical services: Acc. Increased medical facilities
    - Enough food/ availability of food
    - Absence of war/ political stability/ peace
    - Improved standard of living
  - h) Measure the total area of the habitat, throw or mark out the quadrat in the area for the study; at random. Identify label the various species of the plants in the quadrat; count plants of each species; record the numbers, repeat the process (owtte) work out the average per quadrat for each species in the area/ calculate the population for the total area in Nairobi.
11. **1996 Q10 P1**
- (a) O<sub>2</sub> is necessary for germination
  - (b) Germination in B; no fermentation
13. **1996 Q20 P1**
- (a) 10 HRC and 31 HRC
  - (b) (i) A and B  
The numbers of bacteria dividing are few: bacteria are adjusting conditions: few are dying therefore high increase in population
  - (ii) B and C  
More cells are dividing due to suitable environment/ favorable conditions; few are dying; therefore high increase in population
  - (iii) C and D  
No population change; number produced is equal to number dying.
  - (a) Accumulation of toxic wastes; that kills bacteria; depletion of nutrients

leading to competition of space.

- (d) (i) The population will remain the same
- (ii) Temperature not conclusive for division
- (e) – Food to be sufficient for population
- Social amenities/ education; health services

**14. 1997 Q18 P1**

- (a) (i) Bamboo plants  
4 and 6
- (ii) Maize plants  
12 and 14
- (b) (i) Bamboo
- (ii) It had accumulated more weight and therefore greater dry weight
- c) Maize plants have reached maturity/maximum height food being manufactured (in green parts); is utilized for growth storage primary in the cob.
- d) Increase in weight – bamboo reject both increase/ decrease accept bamboo and maize increase/ decrease.
- e) (i) *Dry weight instead of fresh weight*  
Fresh weight is dependant on the amount of water present in the plants and this fluctuates depending on environmental factors.
- (ii) *Weight and height*  
Both given a better measure of growth
- f) *Average height*  
At every 2 weeks measure the height of samples of plants in each plot:  
Divide the total height by the number of plants in each of plot.

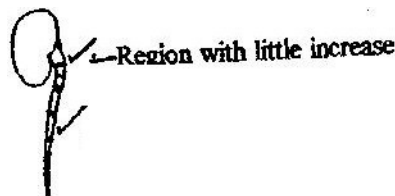
*Average dry weight*

Harvest the sample measure of the plants in each plot; dry to constant weight and divide by the number of plants

- g) Being monocots/ lack (Inter) vascular cambium:

**15. 1999 Q12 P1**

- a) i) -Region of elongation (rapid) growth in a root.
- Region with more increase ink mark
- To provide moisture/water for growth (germination)
- ii)



Region with more increase ink (mark)

- iii) To provide moisture/water for growth (germination)
- b) i) Oxygen
- Oxidation of stored food; to provide energy (for germination)
- ii) Cotyledons
- Store food necessary for germination; protecting the plumule.

16. **1999 Q12 P1**  
The adult and larvae exploit different food/ don't compete for food/ pupa can survive adverse conditions/ pupa being a non-feeding state enables organisms to go through adverse conditions
17. **2001 Q15 P1**  
(a) Water, temperature moisture (Acc. Warmth)  
(b) Mobilize/ hydrolyze stored food/ active enzymes/ breaking of dormancy softening the testa / seed coat ( acc. As a solvent/ transport media.)  
(c) Setup A – those in set up A will germinate  
Setup B- those in set up B will not germinate  
Setup C- those in set C will not germinate
18. **2002 Q4 P1**  
Endosperm material was being oxidized / hydrolyzed / converted into new cytoplasm new material for growth / food used for growth.
19. **2002 Q19 P1**  
- Indole acetic acid/IAA/ Auxins
- Promote cell division tropic responses, ( accept cell division in cambium)
  - Promote formation of abscission layers/ bring abrupt leaf – fall
  - Promote fruit formation ( parthenocarpy)
  - Promotes cell differentiation ( of vascular tissue)
  - Causes apical dominance/ inhibit growth and development of lateral buds
  - Promote growth of adventitious roots ( on stems)
  - IAA + cytokine induce formation of callus tissue ( during healing of wounds)
- N.B if this point for cytokines it should be marked

#### GIBBERELLINS (accept GA3)

- Promotes cell division / cell elongation in dwarf varieties
- Parthenocarpy/ initiating formation of IAA/ setting of fruits after fertilization
- Formation of side branches ( of stems) and dormancy ( in buds); inhibit growth of adventitious roots.
- Activates ( hydrolytic) enzymes during germination/ promotes germination of seeds/ breaks seed dormancy.
- Affects leaf expansion and shapes / retard leaf abscission

#### CYTOKININS' Accept any correct example kinetin 8 zeatin

- Breaks dormancy ( in some species); promotes flowering in some species
- Promotes cell division ( in presence of IAA)
- Stabilizes proteins and chlorophyll
- Promotes root formation
- Low concentration encourages leaf senescence/ high concentration protein increased cell enlargement
- Promotes flowering ( in some species)

#### Ethylene / Ethene / C2H4 ( reject ethane)

- Stimulate lateral bud development
- Ripening of bananas/ fruits
- Induces thickening of stem/ inhibits stem elongation

- Promotes germination of certain seeds/ acc promotes flowering in pineapples
- Causes abscission of leaves/ fruits/ leaf fall abscisic acid / ABA
- High concentration of ABA stomata closure ( by interfering with uptake of potassium ions)
- Inhibits germination/ growth of embryo/ cause seed dormancy
- Causes abscission of leaves/ fruits / leaf fall
- Inhibit elongation growth, inhibit sprouting of bud/ induces dormancy in buds  
(accept Dormin causes/ dormancy in buds/ seeds)

Traumatin

- Heal wounds by callus tissue formation

Florigens

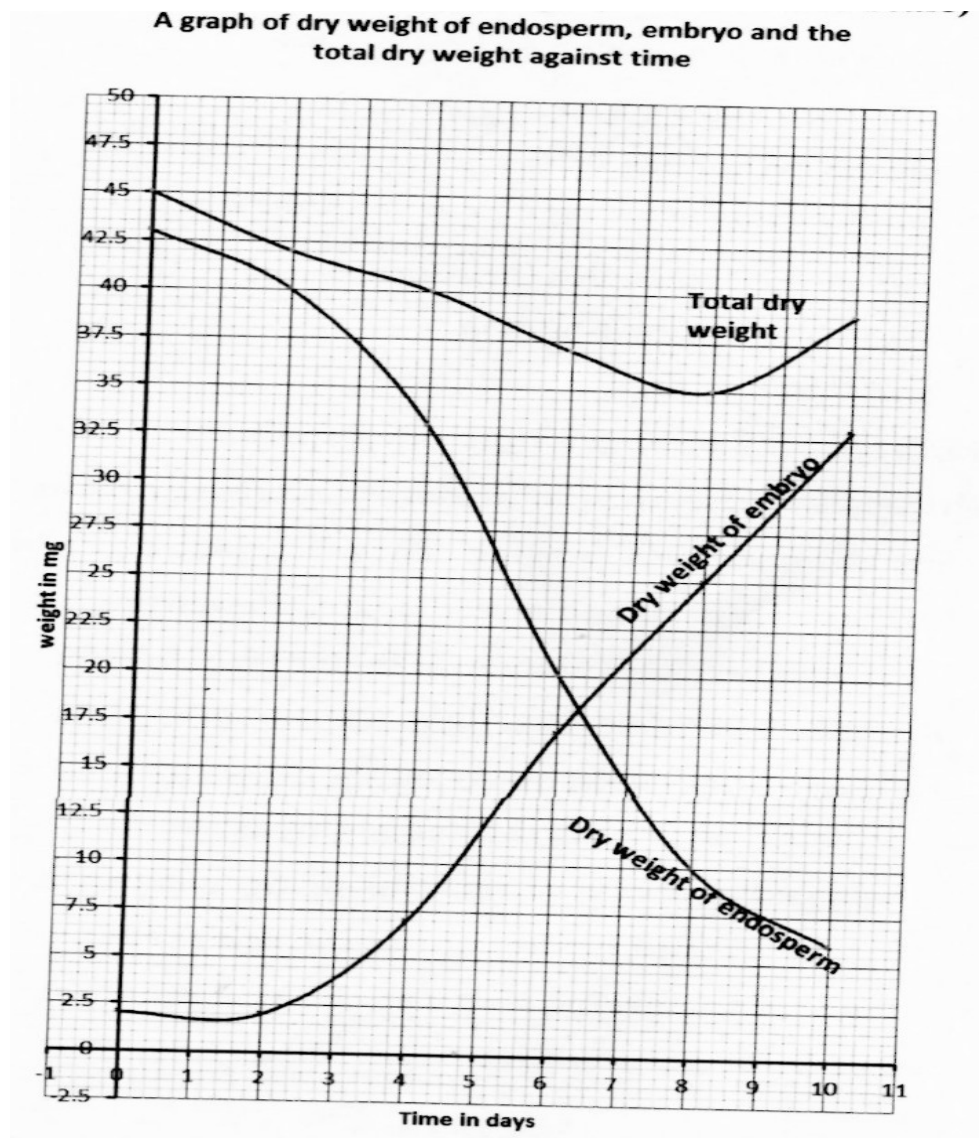
- Promote flowering

**20. 2003 Q7 P1**

- a) Zone of cell division Acc cell multiplication  
Zone of cell elongation / enlargement; Acc expansion for elongation
- b) To protect root tip

**21. 2004 Q17 P1**

- (a) Graph  
Scale: x-axis: 1cm rep 1day, y-axis: 1cm rep 2.5g(not drawn to scale)



(b) 38.5 (mg); Acc. + 0.5 ( i.e. 38 – 39)

(c) (i) Hydrolysis of starch into simple sugars; which are translocated to the embryo; Respiration/ to give energy/ heat/ gases  
 Acc. Simple sugar oxidized  
 Rej. Oxidation of starch/ endosperm.

(ii) New materials are synthesized from protein); bringing about growth of embryo; acc new cells/ protoplasm synthesized

(iii) The rate of respiration is faster than that of synthesis of materials for growth

(iv) First leaf (carried out photosynthesis) leading to growth

(d) (i) Presence of abscisic acid/ germination inhibitors;  
 Embryo not fully developed  
 Absence of hormones/ enzymes that stimulate germination  
 Impermeable seed coat; rej hard seed coat  
 Acc. Inactive enzymes/ hormones/ absence of gibberellins/ cytokinins.

(ii) – Unsuitable / unfavourable temperature

- a. absence of light
- b. lack of water
- c. lack of oxygen
- d. rej. Premature for immature

e) Dense cytoplasm

- Thin cell wall
- Absence of vacuoles (cell sap)

22. 2005 Q8 P1

- Embryo may not yet be fully developed
- Presence of chemical inhibitors e.g. abscisic acid, inhibit germination.
- Low hormone and enzyme concentrations e.g. gibberellins
- Hard and impermeable seed coats, preventing air and water entry.
- Low temperatures which inactivate the enzymes.

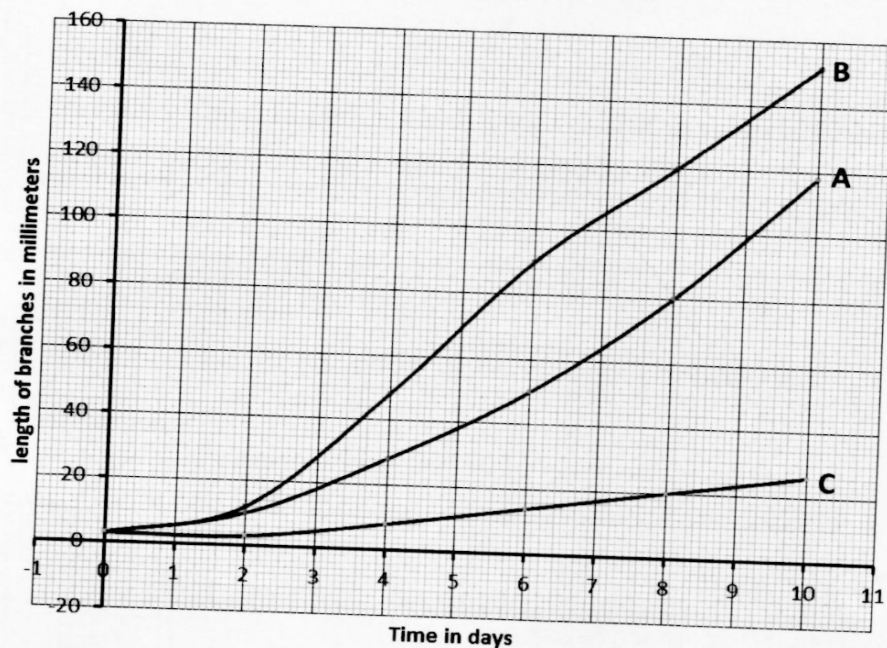
23. 2006 Q14 P1

- (a) Epigeal – cotyledon are brought above ground surface
- Hypogeal- cotyledon remains below surface.

(b) Required in aerobic respiration/ oxidation; to release energy from food reserve for germination; rej. Oxidation for starch (i.e. starch cannot be oxidized before hydrolyzed).

24. 2006 Q6 P2

(a) Scale: x-axis; 1cm rep 1 day, y-axis; 1cm rep 20 mm (not drawn to scale)  
A graph showing length of branches in three shoots against time in days



- (b) (i) 105 + 1 (mm)
- (ii) 134 – 140 (mm)

(c) **Graph A:** The tip of the shoot which was removed contained indole acetic acid (IAA); which causes apical dominance/ inhibits growth/ development of more

lateral buds; hence lateral buds sprouted/grew.

**Graph B;** the gibberellic acid which was added on the cut. Promotes formation of lateral branches of stems, hence the fast growth of branches on shoot b.

**Graph C;** The shoot tip which remained intact contains IAA which inhibits growth/ development of lateral buds; hence little change of length of lateral branches.

- (d) Control
- (e) Increase productivity
- (f) Promote cell division, and cell elongation

25. 2007 Q19 P1

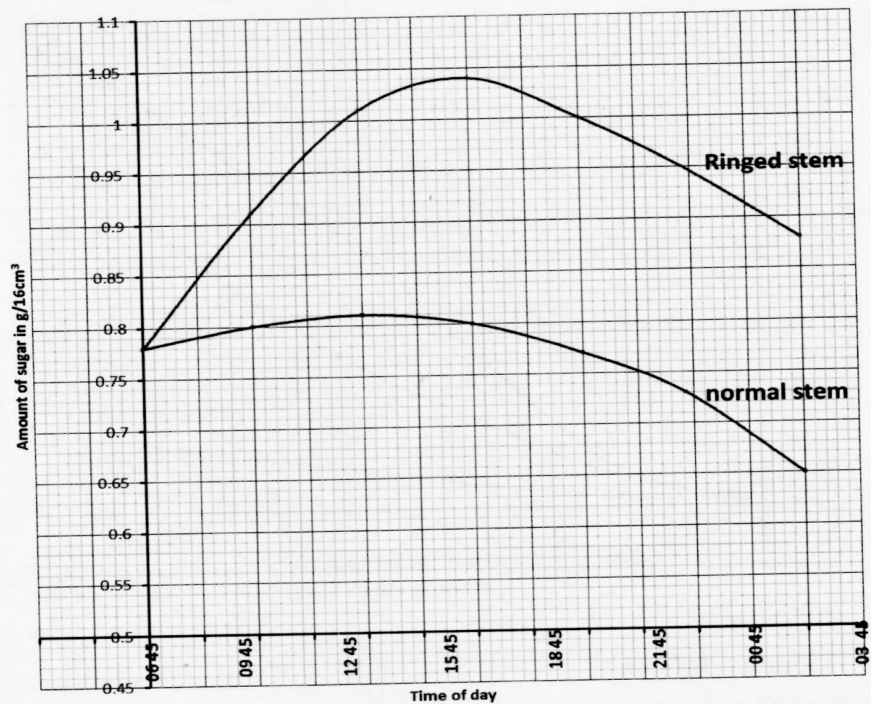
- (a) – absence of water (moisture)
  - Unsuitable temperature
  - Lack of oxygen
  - Lack of light
- (b) Hypocotyl

26. 2007 Q6 P1

- (a) See graph

(a) Scale: x-axis: 1cm rep 1.5 hours, y-axis: 1cm rep 0.05 g

A graph showing amount of sugar in grammes of a ringed stem and normal stem at different times



- (b) (i) 15: 45
- (ii) 12:45
- (c) 0.79 + 0.02 grammes
- (d) The food that had been manufactured the previous day had been converted to soluble sugars and was being translocated to other parts of the plant.
- (e) 0645 hours and 15 45 hours

- There was low concentration of sugars early in the morning as there was little translocation
- As day progresses the light intensity increases and more food is manufactured thus more translocation increasing concentration of sugars

(ii) 15 45 hours and 0045 hours

- The light intensity is decreasing reducing rate of photosynthesis. Less food is manufactured hence less is translocation
- As it turns dark there is no photosynthesis reducing concentration of sugars translocated.

(iii) Sieve plates

- Cytoplasm strands

(f) Amino acids

- Soluble fats/ lipids

27. **2008 Q17 P1**

- (a) Few dividing cells/ cells not adjusted to surrounding environment
- (b) Most cells fully differentiated/ rate of cell division equals rate of cells dying

28. **2008 Q21 P1**

- (a) State during which a seed cannot germinate/ state of rest before seed germination; re: inability to germinate.
- (b) Abscissic acid

29. **2009 Q4 P1**

- (a) (seed) dormancy; / *Rej Dormancy*
- (b) (i) Epigeal
- (ii) Protection of the delicate plumule; Pulls the Cotyledons above the ground; *ref shoot*

30. **2009 Q11 P1**

- (a) Auxiliary / lateral buds sprout / branches will be formed;
- (b) Decapitation removes the hormone / auxins / IAA which is produced in the terminal bud / the stem tip; abscise / removal of the hormone / auxins / IAA promote branch development of auxiliary lateral buds;

31. **2010 Q25 P1**

- Overcrowding
- Accumulation of toxic wastes
- Limited resources such as nutrients

32. **2010 Q30 P1**

The inhibition of growth of lateral buds; by auxins; produced by the growing apical bud.

33. **2011 Q29 P1**

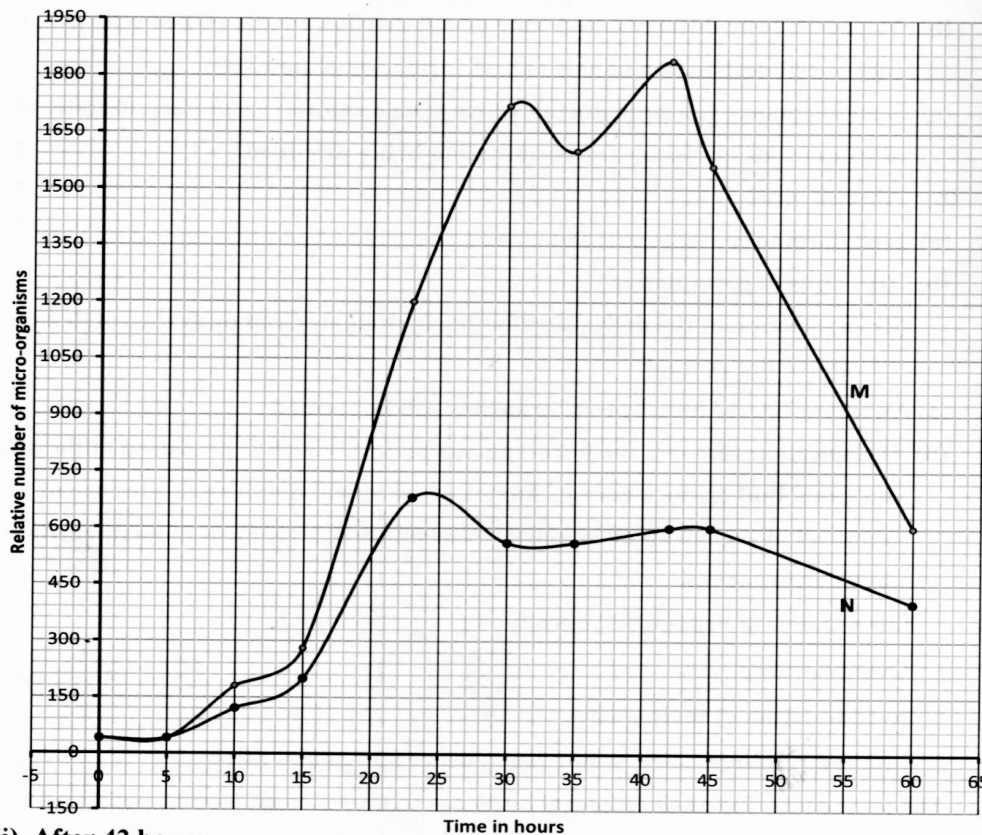
- Active enzymes; provide a medium for enzymatic activities (to break down stored food to soluble form.
- Hydrolyses; dissolves food material;
- Is a medium of transportation of dissolved food substances to growing regions of radical and plumule;

-Softens seed coat to facilitate emergence of radicle;

34. 2011 Q6a P2

(i) Scale: x-axis; 1cm rep 5 hours, y-axis: 1cm rep 150 organisms  
(not drawn to scale)

A graph showing relative number of micro-organisms against time



i) After 42 hours

(i) 42 hours

(ii)

- M at 50hrs= 1240 ( $1220 \pm 20$ )
- N at 50hrs= 560 ( $540 \pm 20$ )
- Possible answer  $680 \pm 40$   
**640 – 720;**

(iii)

- Population decreases; high temperature kill the micro-organisms/ denature enzymes;  
Account for the shape of the curve for population in petri-dish N between 46 hours and 59 hours
- Population (growth rate) decreases; death rate of (micro-organisms) is higher than (their population) rate of multiplication; due to exhaustion of nutrients; and accumulation of toxic waste; shortage of oxygen; overcrowding / shortage of space;

35. 2012 Q20 P1

Height/length; weight/mass/dry weight; surface area;

36. 2012 Q25 P1

Ecdysone hormone; cause metamorphosis(forwards adult stage)/ cause moulting/ecdysis

Juvenile hormone; maintains larval characteristics/cause formation of larval cuticle/inhibits moulting/metamorphosis;

37. 2013 Q19 P1

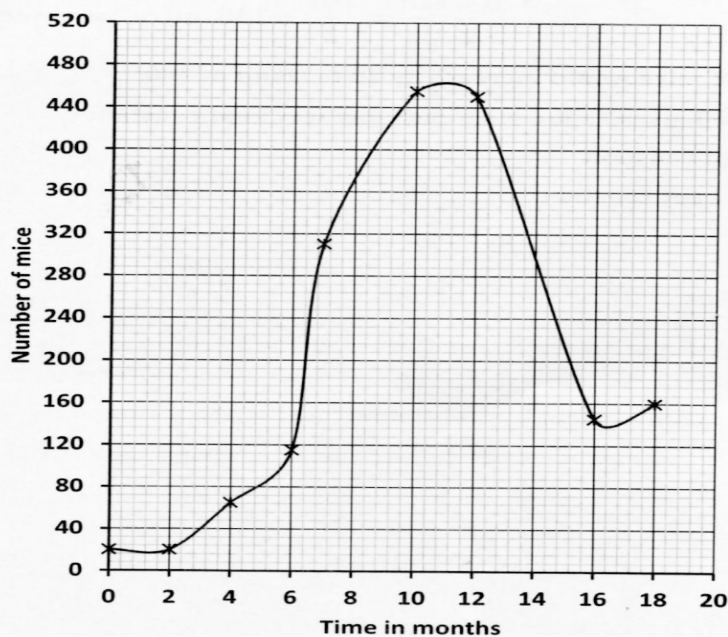
- embryo not fully developed
- hard and impermeable seed coat / testa
- presence of chemical inhibitors that inhibit germination
- low concentration of hormones and enzymes that promote germination
- lack of environmental factors like water,  $\text{CO}_2$ , absence of light of certain wavelength

38. 2013 Q27 P1

| Complete metamorphosis                                         | Incomplete metamorphosis                            |
|----------------------------------------------------------------|-----------------------------------------------------|
| a) involves 4 series of changes i.e egg-larva-pupa-adult       | a) involves 3 series of changes i.e egg-nymph-adult |
| b) growing stage in larva is different in form from adult form | b) growing state in nymph is similar to adult form  |

39. 2013 Q6 P2

(a) scale: x-axis: 1cm rep 2 months, y-axis: 1 cm rep 40 mice  
A graph showing number of mice against time in months



b) (i) population of mice is constant due to:-

- the reproducing mice are still immature
- mice are still adjusting to their new environment

(ii) population of mice rose steadily due to:-

- an increase in the number of reproducing females.
- plenty of food for the mice.
- mice are already adapted to their new environment

(iii) population of mice rose rapidly due to:-

- there are many reproducing females
- plenty of food to the mice

(iv) population of mice almost constant but declining slowly due to:-

- stiff competition for food hence food is not adequate
- stress due to limited space
- accumulation of wastes which can be toxic

(c) (i) Between the 6<sup>th</sup> and 7<sup>th</sup> months

(ii) rate of population change =  $\frac{\text{change in mice population}}{\text{time}}$

(d) the population of mice would increase by 20 to stand at 180

- (e)
- amount of food given to the mice each day was kept constant
  - space was kept constant
  - sex ratio was kept constant

#### 40. 2014 Q2 P1

(a) A period of rest in which a seed performs its physiological processes slowly and utilizes little food.

(b) State three causes of seed dormancy (3 marks)

- Chemical / growth / germination inhibitors;
- Hard / impermeable seed coat ;
- Long/ freezing temperatures; reject unfavorable temperature
- Under developed / immature embryo, reject premature/ undeveloped embryo
- Low concentration of hormones / enzymes.

#### 41. 2014 Q6 P1

- Cell division
- Cell elongation
- Development of adventitious roots
- Causes apical dominance
- Causes tropic responses