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About 

(PURE) BIOLOGY

(TOPICAL)

About Thinking Process

When solving problems, we first analyse the questions and then gather relevant information until we are able to determine the answers. But for presentation reason, we need to organise, rearrange and then present ONLY the required workings and solutions.

Thinking process reveals the extra but relevant information which is not required as part of the solutions.

About MCQ with HELPs

Explanations are given so that students know exactly why the answer is the right one.

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MCQ Answers

UNIT 5 Enzymes

MCQ Section

1. Four test tubes, each containing 2 cm^3 of amylase solution are treated as follows:

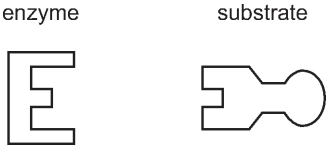
1 boiled, then cooled to 1 °C
2 boiled, then cooled to 25 °C
3 frozen, then warmed to 1 °C
4 frozen, then warmed to 25 °C

10 cm^3 of starch solution were then added to each tube and after 5 minutes, 2 drops of iodine solution were added to each tube.
Which row shows the results?

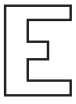
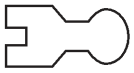
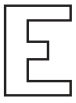
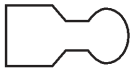
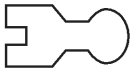
	1	2	3	4
A	black	black	black	yellow
B	black	yellow	black	yellow
C	yellow	black	yellow	black
D	yellow	yellow	yellow	black

[J13/P1/Q4]

2. The diagram represents the 'lock and key' mechanism of an enzyme that works best at pH 7.

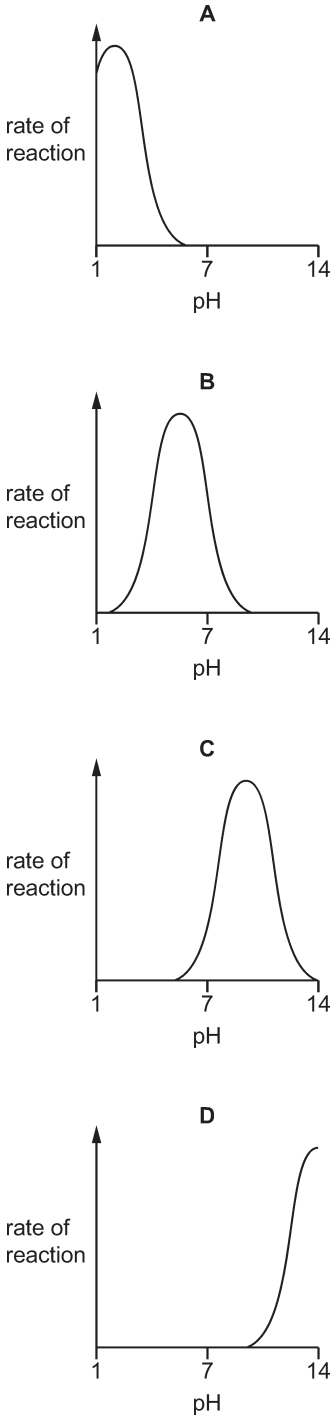


What shows the enzyme and its substrate at pH 13?

	enzyme	substrate
A		
B		
C		
D		

[J14/P1/Q4]

3. Which graph best represents the effect of pH on the action of gastric protease?



[N14/P1/Q4]

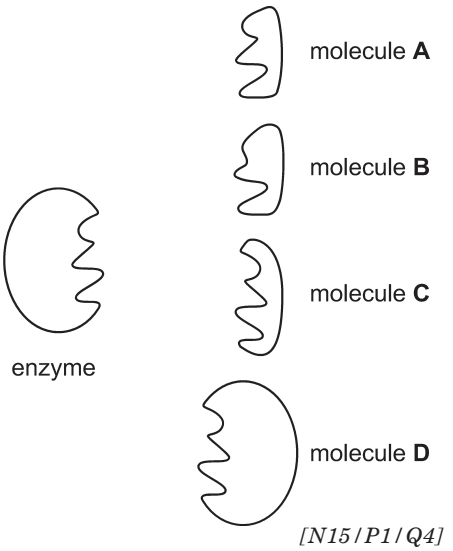
1. A Starch is added to each test tube to see whether amylase is active. If enzyme is inactive, then iodine test will show black colour. Only tube 4 shows hydrolysis, so yellow colour of iodine solution appears, as starch is not present.

2. C At pH 13, active site of enzyme is altered, so substrate of specific complementary shape cannot fit into it.

3. A Gastric protease is pepsin which acts best in acidic or pH 2-3. Only graph **A** shows its highest activity at this pH.

4. The diagram represents an enzyme and four molecules, **A**, **B**, **C** and **D**.

Which molecule is the substrate of this enzyme?



[N15/P1/Q4]

5. Amylase solution is tested with Benedict's solution, biuret solution and iodine solution.

Which colours are obtained?

	Benedict's solution	biuret solution	iodine solution
A	blue	blue	blue-black
B	blue	blue	brown
C	blue	purple	brown
D	red	purple	blue-black

[J16/P1/Q4]

6. Which property of enzymes is explained by the lock and key hypothesis?

A All enzymes are proteins.

B Enzymes are inactive at very low temperatures.

C Human enzymes are most active just below 40 °C.

D Most enzymes can only catalyse one reaction.

[J17/P1/Q4]

7. According to the lock and key hypothesis, what is the lock and what is the key for the enzyme lipase?

	lock	key
A	lipids	fatty acids
B	fatty acids	lipase
C	lipids	lipase
D	lipase	lipids

[N17/P1/Q4]

8. In an enzyme's action, where is the active site and where are the lock and the key?

	active site	lock	key
A	on the enzyme	on the enzyme	on the substrate
B	on the enzyme	on the substrate	on the enzyme
C	on the substrate	on the enzyme	on the substrate
D	on the substrate	on the substrate	on the enzyme

[J18/P1/Q4]

9. What are enzymes?

A fats that are secreted by glands in the digestive system

B fats that have a characteristic molecular shape

C proteins that act as biological catalysts

D proteins that are unaffected by temperature

[N18/P1/Q4]

10. Some organisms live at the bottom of the sea where it is very dark. To synthesise glucose, they use energy from chemicals in the very hot water that comes out of volcanoes.

What is a distinguishing feature of these organisms?

A Their enzymes are easily denatured by heat.

B They do not need carbon dioxide.

C They do not need to be green.

D They obtain energy only as carnivores.

[N18/P1/Q5]

MCQ Answers

4. A Substrate should be complementary in shape to the active site of enzyme.

5. C Since amylase is a protein, so due to biuret test, it turns purple. In other tests, no color change occurs.

6. D Enzymes are specific so they mostly catalyse one reaction. Specific substrate is like a key and enzyme is like a lock.

7. D Enzyme is said to be lock, so lipase is the enzyme, hence it is lock, while substrates are lipids which are called key.

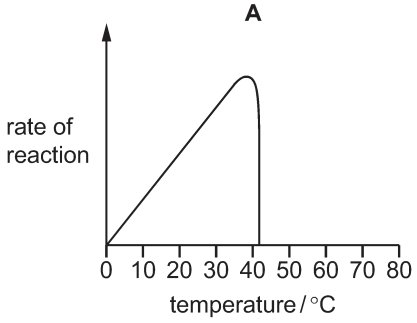
8. A Enzyme contains active site complementary in shape to substrate.

9. C Fats cannot be enzymes. Only proteins can be enzymes and these are affected by temperature.

10. C Enzymes of such organisms work at very high temperature but in the darkness they don't have chlorophyll, so are not green.

11. Which graph shows the effect of temperature on the rate of a reaction catalysed by amylase?

A



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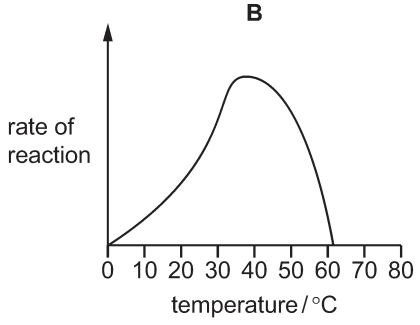
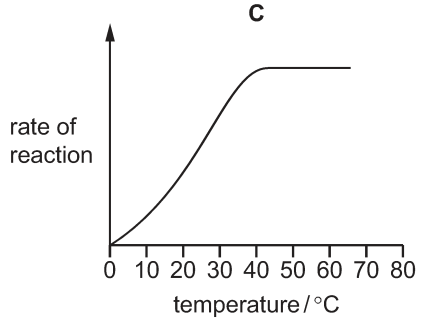


C



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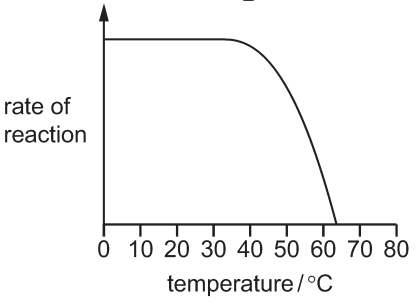


[J19/P1/Q4]

12. What happens to an enzyme after it has catalysed a reaction?

A It can no longer fit the substrate molecules.

B It can now catalyse several different reactions.

C It has become part of the product molecules.

D It is available to catalyse the same reaction again.

[N19/P1/Q4]

13. Which substance is an enzyme?

A chlorophyll **B** fibrinogen

C insulin **D** lipase

[J20/P1/Q4]

14. Starch digestion occurs in the mouth cavity and in the duodenum but it stops in the stomach.

Why is this?

A All the starch has been digested before it reaches the stomach.

B Cells in the stomach do not produce amylase.

C The pH in the stomach changes the shape of the amylase.

D The temperature in the stomach is too high for amylase to work.

[N20/P1/Q4]

15. Which word describes an enzyme that has its active site changed by high temperature?

A denatured

B destroyed

C deleted

D distorted

[J21/P1/Q4]

16. Which statement about enzymes is always correct?

A They change reactions to produce different end products.

B They change the rate of reactions.

C They catalyse reactions inside body cells.

D They catalyse reactions at body temperature.

[N21/P1/Q4]

MCQ Answers

11. B By increasing temperature, activity of enzyme increases until optimum temperature of 40 °C and then it starts decreasing as higher temperature makes the enzyme inactive and finally denatured.

12. D Its active site is again vacant and it is available for substrate molecule to bind and catalyse a reaction again.

13. D Chlorophyll is a pigment, fibrinogen is a protein, insulin is a hormone, while lipase is an enzyme.

14. C Amylase from mouth cavity reaches stomach, where HC*l* lowers the pH, and amylase shape is changed. So it can't recognize starch molecules.

15. A When active site or 3-D structure of an enzyme changes, then it is said to be denatured.

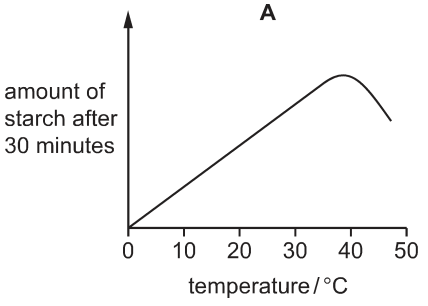
16. B Enzymes are catalysts which change or increase the rate of reaction. All other statements are also correct but not for every enzyme.

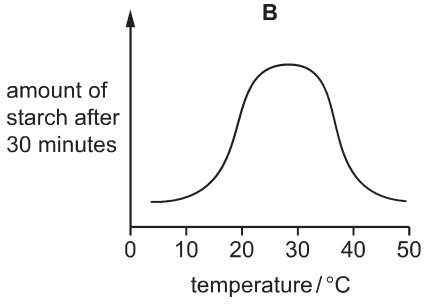
17. Amylase is an enzyme that breaks down starch to maltose.

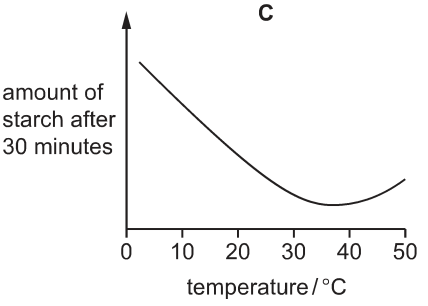
Students set up an experiment to investigate the effect of different temperatures on the action of amylase on starch solution.

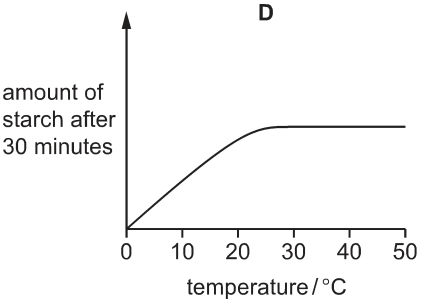
They measured the amount of starch remaining after 30 minutes at different temperatures.

Which graph would you expect the students to draw from their results?









[J22 / P1 / Q5]

18. Which statement identifies the optimum (best) temperature for enzyme activity?

A It is the highest temperature at which any enzyme activity happens.

B It is the highest temperature that does not destroy an enzyme.

C It is the lowest temperature that denatures an enzyme.

D It is the temperature that produces the highest rate of enzyme activity.

[J22 / P1 / Q6]

19. Fats are broken down by the enzyme lipase to produce fatty acids and glycerol.

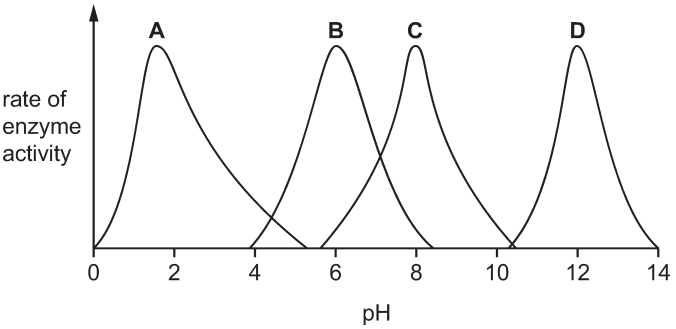
According to the 'lock and key' model of enzyme action, what is the 'lock' and what is the 'key' in this reaction?

	lock	key
A	fats	lipase
B	lipase	fats
C	fats	fatty acids and glycerol
D	lipase	fatty acids and glycerol

[N22 / P1 / Q5]

20. The graph shows the effect of varying pH values on the activity of four different enzymes, **A**, **B**, **C** and **D**.

Which enzyme is active in the stomach?



[N22 / P1 / Q6]

MCQ Answers

17. C Till optimum temperature, i.e., 40 °C, activity of amylase is maximum, so most of the substrate or starch is broken down to maltose and lesser is the remaining starch. After 40 °C, enzyme becomes less active, so amount of remaining starch also increases.

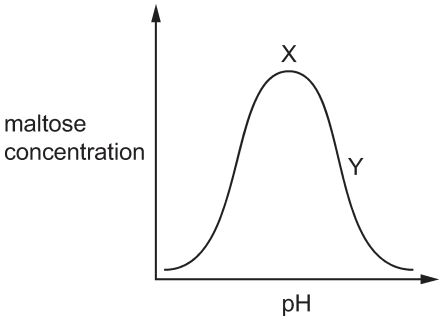
18. D At optimum temperature, activity of enzyme is maximum.

19. B Lipase is the enzyme having active site, so it is the lock and fats are its substrates which fit into active site, hence, fats are like a key.

20. A In stomach, pH is very low due to HC*l*, i.e., 2-3, hence only pepsin is active at this pH.

MCQ Answers

21. The graph shows the concentration of maltose produced when amylase digests starch at different pH values.



What explains the shape of the graph between point X and point Y?

A The enzyme is completely denatured and does not work at all.

B The enzyme molecules have less kinetic energy.

C The shape of the enzyme active site is changing and does not fit the substrate so well.

D The substrate molecules have more kinetic energy.

[J23/P1/Q6]

22. Which statement describes enzyme-catalysed reactions?

A All enzymes work best at the same pH.

B As an enzyme-catalysed reaction progresses, the concentration of reactants increases.

C As the temperature of an enzyme-catalysed reaction increases from 0 °C to 20 °C, the frequency of effective collisions increases.

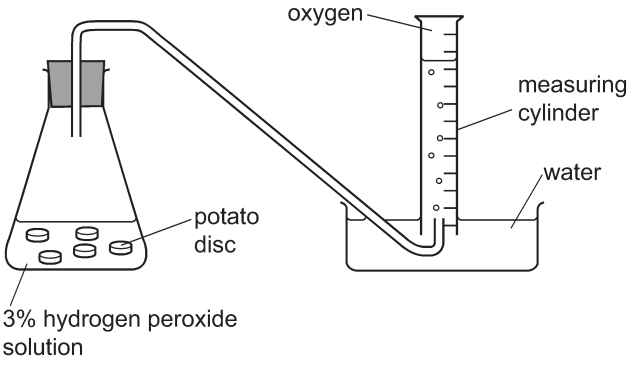
D Enzymes are denatured as the temperature of an enzyme-catalysed reaction is lowered from 20 °C to 0 °C.

[N23/P1/Q6]

23. Catalase is an enzyme found in potato tissue. It catalyses the breakdown of hydrogen peroxide into water and oxygen.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water + oxygen}$$

The apparatus shown was used to investigate the activity of catalase.

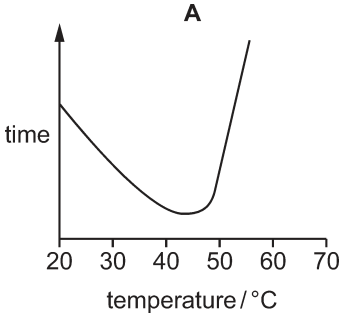


Five identical potato discs were dropped into 15 cm^3 of a 3% hydrogen peroxide solution at a temperature of 20 °C. The time taken for 5 cm^3 of oxygen to be produced was recorded.

This procedure was repeated at each of the following temperatures: 30 °C, 40 °C, 50 °C, 60 °C and 70 °C.

Which graph shows the results of the investigation?

A



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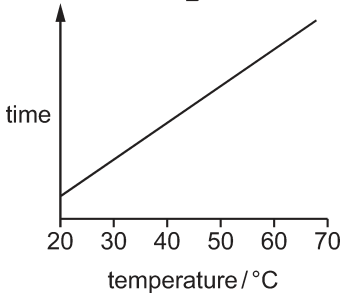


21. C At X, enzyme shows maximum activity but after that with increasing pH, its activity decreases, as bonds like Hydrogen or ionic are breaking, so shape of its active site changes and less substrates are able to fit into it.

22. C By increasing temperature, more collisions occur due to more kinetic energy, hence probability of substrates fitting into active sites of enzymes also increases.

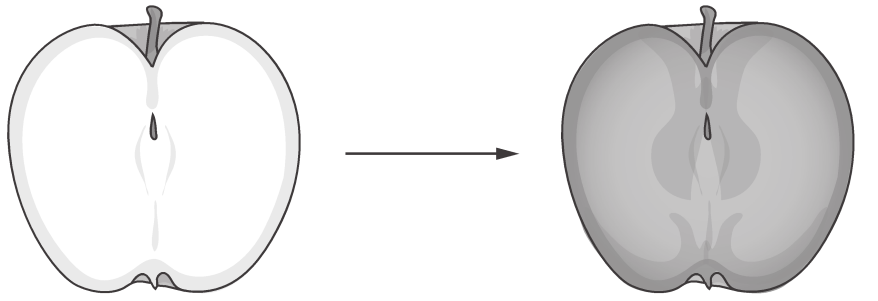
23. A By increasing temperature till 40 °C or optimum temperature, enzyme activity increases, so products are formed in lesser time. After optimum, higher temperature denatures the enzyme and its activity decreases.

UNIT 5 Enzymes

THEORY Section

Question 1

When an apple fruit is cut open, the cut surface of apple tissue quickly becomes brown and is less likely to be eaten. This change in colour is shown in the diagram.



white apple tissue immediately after being cut

brown apple tissue a short time after being cut

The change in colour of the apple tissue is due to a series of chemical reactions. An enzyme called PPO acts as a catalyst for one of these reactions.

(i) State what is meant by the term *catalyst*. [2]

(ii) The change in colour can be prevented by placing the cut surface of apple tissue in boiling water for a short time immediately after the fruit is cut.

Explain this observation using the *lock and key* hypothesis of enzyme action. [4]

[N20 / P2 / Q3(a)]

Solution

(i) Catalyst is a chemical which increases the rate of reaction. It is not consumed or used in the reaction itself, so remains unchanged, hence can be reused. It decreases the activation energy of reaction.

(ii) Enzyme is specific for a specific substrate. It contains an active site which is denatured or changes shape due to high temperature. So substrate is not able to fit into active site as it is no longer complementary to the shape of substrate. Enzyme-substrate complexes are not made, so reaction cannot take place rapidly. Rate of reaction is reduced and less or no products are made.

COMMENT on **ANSWER**

"**(i)** A catalyst does not initiate or start a reaction but it can cause increase in the rate of reaction. Catalyst acts on reactants. Enzyme is biological catalyst and its reactants are called substrates.

(ii) Enzymes are denatured at boiling temperature. Their 3-D shape is damaged or destroyed. So shape of their active sites is also changed. "

Question 2

Some laundry detergents used to wash clothes contain enzymes.

These enzymes break down the molecules that cause stains.

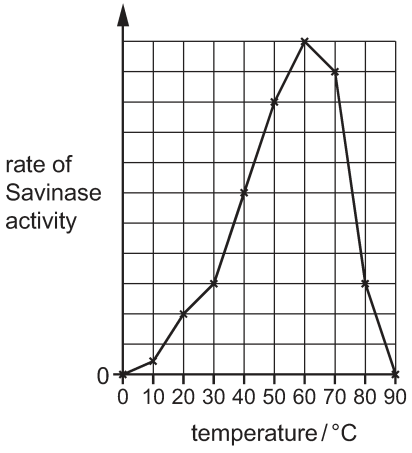
(a) Suggest enzymes that may be components of a laundry detergent that will break down stains made of:

starch ..... fat ..... [2]

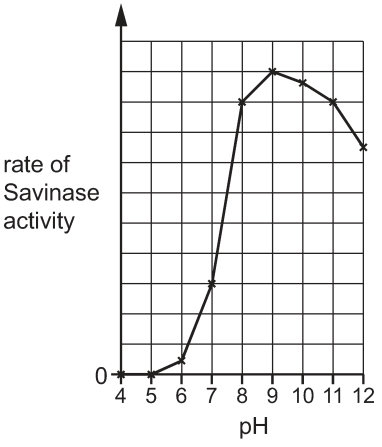
(b) Savinase is a protease enzyme produced by genetically engineered bacteria.

The enzyme is a component of laundry detergents.

The graphs show the results of an investigation into the effects of temperature and pH on the rate of Savinase activity.



effect of temperature



effect of pH

(i) Describe how the effect of temperature on Savinase activity differs from the effect of temperature on a protease that functions in the human stomach. [3]

(ii) Suggest why laundry detergents that contain Savinase also contain chemicals that dissolve to form an alkaline solution. [2]

(iii) After washing clothes using laundry detergents, the waste water is sometimes released into the environment.

This waste water contains inorganic phosphate ions that are also found in fertilisers.

Explain the harmful effect on aquatic life of releasing this waste water into the environment. [4]

[N21 / P2 / Q5]

Solution

(a) Starch: Amylase.

Fat: Lipase.

(b) (i) Optimum temperature of savinase is 60 °C, while that of human protease in stomach is 37 °C. By raising temperature from 60 °C to 90 °C, savinase becomes inactive and finally denatured while human protease stops functioning by slight increase of temperature.

(ii) At alkaline pH, Savinase enzyme works faster like at optimum pH of 9. Alkaline pH prevents denaturation of enzyme, so detergent becomes more effective and clothes get cleaner.

COMMENT on **ANSWER**

"**(a)** Amylase breaks down starch to produce maltose and lipase breaks down lipids to produce fatty acids and glycerol. "

(iii) Such waste water from laundry is causing pollution in soil and when it reaches nearby rivers, streams or canals, it causes eutrophication or increase in mineral ions like inorganic phosphates. It increases growth of phytoplanktons due to which less oxygen goes down in water. As a result consumer animals like fish die.

COMMENT on **ANSWER**

"**(b)** **(iii)** Eutrophication also prevents light to pass down as algal blooms occur at the surface water. Aerobic bacteria utilize surface oxygen faster in competition with consumer animals like fish, so depletion of oxygen causes death of aquatic animals. "

Question 3

A student investigates the use of an enzyme in fruit juice production.

The student carries out the following steps:

- cuts one apple into small pieces
- puts the same number of pieces into each of three beakers, **A**, **B** and **C**
- adds 2 cm^3 of a dilute enzyme solution to the apple in beakers **A** and **B**
- adds 2 cm^3 of distilled water to the apple in beaker **C**
- places each beaker in a water-bath at a constant temperature for 30 minutes
- filters the juice from each beaker into a separate measuring cylinder and records the volume of juice collected in each measuring cylinder.

(a) **(i)** Identify the enzyme that the student should add to the apple in beakers **A** and **B**. [1]

(ii) Outline the reason why the student set up beaker **C**. [1]

(b) The results of the student's investigation are shown in Table 5.1.

Table 5.1

beaker	temperature of water-bath /°C	volume of juice collected /cm^3
A	45	20
B	90	5
C	45	5

Use your knowledge of enzyme action to explain these results. [5]

(c) Bacteria can be genetically modified to produce enzymes for use in biotechnology.

State **two** reasons why bacteria are suitable for this purpose. [2]

[N23 / P2 / Q5]

COMMENT on **ANSWER**

"**(a)** **(i)** Enzyme cellulase may also be written.

(ii) Purpose of control is to show how much juice is formed without an enzyme.

(c) In bacteria, there are no ethical reasons against their use. They multiply rapidly due to short life cycle. It is easy to grow or produce bacteria in a liquid medium, and they are able to make complex molecules like enzymes. "

Solution

(a) **(i)** Pectinase

(ii) This beaker acts as a control for fair comparison.

(b) Beaker **A** produced more juice than beaker **B**. Beaker **A** is at 45 °C, so due to more effective collisions, enzyme is working efficiently. Beaker **B** is at 90 °C, in which enzyme is denatured, so enzyme is not working. At optimum temperature, active sites of enzymes remain occupied by substrates, but when denatured, active sites are no longer recognised by substrates due to their changed shape; hence, substrate can't fit into complementary active sites.

(c) 1. Bacteria have plasmids and rapid growth rate.

2. Due to asexual reproduction or binary fission, all bacteria are genetically identical.

UNIT 16.1 Reproduction in Plants

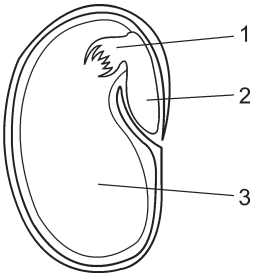
MCQ Section

1. What is the function of the sepals of most flowers?

A to attract insects
B to produce pollen
C to protect flower buds
D to receive pollen

[J14/P1/Q33]

2. The diagram shows a section of a seed.



What are the numbered parts?

	1	2	3
A	cotyledon	plumule	radicle
B	plumule	cotyledon	radicle
C	plumule	radicle	cotyledon
D	radicle	plumule	cotyledon

[N14/P1/Q34]

3. A male gamete leaves the pollen tube immediately after the pollen tube has entered which structure?

A ovary **B** ovule
C stigma **D** style

[J15/P1/Q33]

4. What is always essential for seeds to begin germinating?

A carbon dioxide
B light
C mineral salts
D oxygen

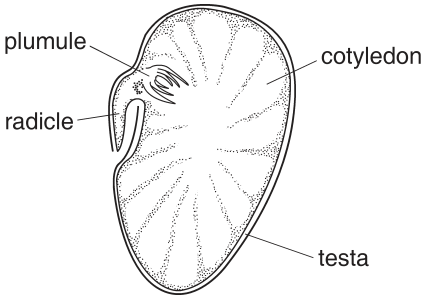
[J15/P1/Q34]

5. What passes down a pollen tube after pollination?

A female nucleus
B male nucleus
C ovule
D pollen grain

[N15/P1/Q34]

6. The diagram shows a broad bean seed. Part of it has been cut away to show the internal structure.



Which parts make up the complete embryo?

A radicle, plumule, cotyledons and testa
B radicle, plumule and cotyledons only
C radicle and plumule only
D radicle only

[N15/P1/Q35]

7. Which process in a developing seedling needs light energy?

A breakdown of food reserves
B respiration
C synthesis of organic material
D uptake of salts and water

[J16/P1/Q33]

8. A number of new plants are growing from pieces of a plant that have become detached and have rooted in soil.

Which statement is correct about these new plants when they mature?

1. C Sepals are usually of green colour which cover a flower from outside, so give protection.

2. C Plumule is upper part which develops into shoot while radicle is lower part which grows into root. Cotyledon contains reserved food material.

3. B Pollen tube grows and elongates to the ovule where ovum is found and male gamete fertilises with it.

4. D Oxygen is certainly needed for germination of seeds.

5. B Pollen tube is made by pollen grain for transfer of male nucleus to ovum in the ovary.

6. B Embryo gets nutrition from cotyledon. When seed germinates, embryo forms radical and Plumule.

7. C Photosynthesis makes organic material which needs light.

8. C Since these plants are genetically same, so their flowers have same color.

A The fruit they produce will all ripen at the same time.

B They will all grow to the same size.

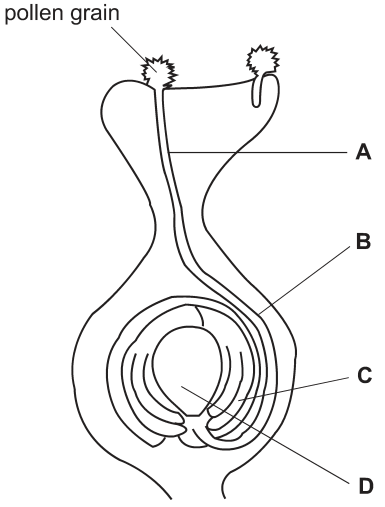
C They will all have the same colour flowers.

D They will all produce the same number of fruit.

[J16/P1/Q34]

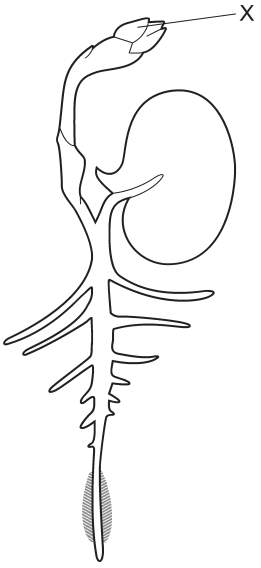
9. The diagram shows the development of a pollen tube and its entry into the ovule.

Which part develops into the testa after fertilisation?



[N16/P1/Q33]

10. The diagram shows a broad bean seedling.



From which part of the seed did structure X develop?

A cotyledon

B plumule

C radicle

D testa

[N16/P1/Q34]

11. Which plants are most likely to adapt successfully to a climate change in their environment?

A plants that are cross-pollinated

B plants that do not rely on wind-pollination

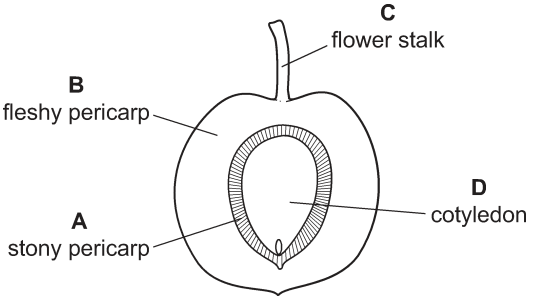
C plants that grow rapidly

D plants that reproduce asexually

[J17/P1/Q32]

12. The diagram shows a section through a plum fruit.

Which structure has a genotype different to the other three?



[J17/P1/Q33]

13. Which conditions are needed for the germination of most seeds?

	light	oxygen	water
A	✓	✓	×
B	×	✓	×
C	✓	×	✓
D	×	✓	✓

key

✓ = yes

× = no

[N17/P1/Q34]

MCQ Answers

9. C Integuments around ovule develop into testa of seed.

10. B Radicle develops into root and plumule develops into shoot.

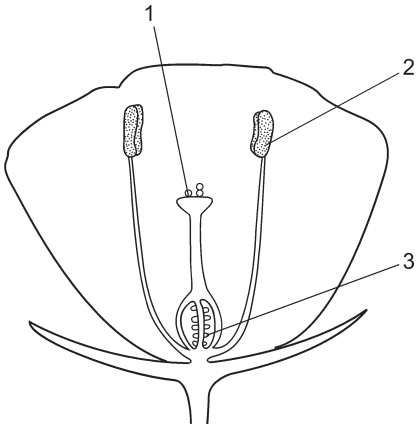
11. A Cross-pollinated plants show more variation, so can adapt to climate change.

12. D Cotyledon is a triploid tissue, so its genotype is different from other tissues.

13. D Seed germination usually occurs in darkness. However, without water and air germination is not possible.

MCQ Answers

14. The diagram shows a section through a flower.



Which statement is correct?

A Fertilisation occurs at 1.

B Haploid gametes are produced at 2 and 3.

C Pollen is transferred by insects to 3.

D The pollen grain fuses with the female nucleus at 2.

[J18/P1/Q34]

15. What are two male parts of a flower?

A anther and carpel

B anther and filament

C carpel and filament

D stamen and style

[N18/P1/Q34]

16. A male gamete leaves the pollen tube immediately after the pollen tube has entered which structure?

A ovary **B** ovule

C stigma **D** style

[J19/P1/Q33]

17. 1000 seeds were placed in damp soil, in the dark, at 25 °C for 4 days. Each day equal numbers of germinating seeds were removed, dried, and their components separated and weighed.

The table shows the results.

	day				
	0	1	2	3	4
mean mass of whole seeds / mg	205	193	185	170	158
mean mass of seed cotyledons / mg	180	155	131	125	115
mean mass of radicle and plumule / mg	2	5	9	14	21

Which statements are supported by the data from this investigation?

1 Stored food in cotyledons provides materials for the growth of the radicle and plumule, during germination.

2 Whole seeds contain other structures beside the plumule, radicle and cotyledons.

3 Some stored food is respired to provide energy, and carbon dioxide is lost to the air.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

[J19/P1/Q34]

18. Which structure contains the ovary of a flowering plant?

A anther

B carpel

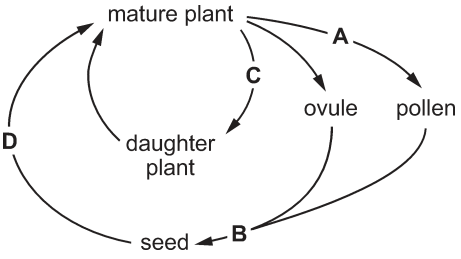
C ovule

D pollen grain

[N19/P1/Q33]

19. The diagram shows the life cycle of a species of plant.

During which stage does meiosis (reduction division) occur?



[N19/P1/Q34]

14. B 2 is anther producing haploid pollen grains and 3 is ovule having haploid ovum. 1 is stigma, where pollen grain falls and germinates making a pollen tube.

15. B Anther contains pollen grains or male gametes. Anther is located at the end of a filament .

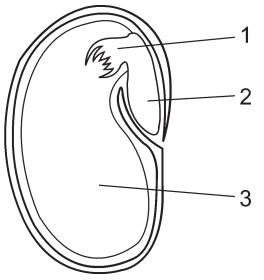
16. B Pollen tube is elongated from pollen grain and it extends uptil an ovule, where male gamete has to fertilise an ovum.

17. A Stored food in seed cotyledons is used for germination which causes increase in mass of radicle and plumule. Stored starch is broken down to glucose which undergoes respiration to provide energy for germination.

18. B Carpel is female part of a flower. It contains ovary, stigma and style. Pollen grain falls on stigma and germinates pollen tube passing through style to ovule in the ovary.

19. A Due to reduction division or meiosis, male and female gametes, i.e., pollen grains and ova are formed. Ova are found in the ovule.

20. The diagram shows a section of a seed.

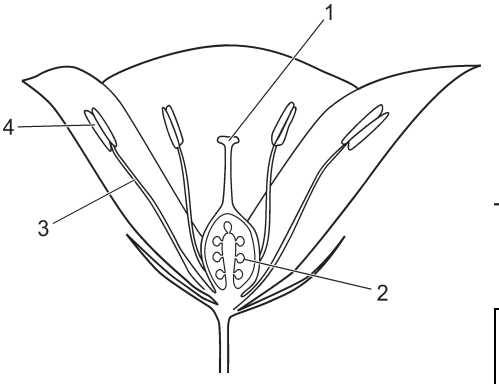


What are the numbered parts?

	1	2	3
A	cotyledon	plumule	radicle
B	plumule	cotyledon	radicle
C	plumule	radicle	cotyledon
D	radicle	plumule	cotyledon

[J20/P1/Q33]

21. The diagram shows a flower cut in half.

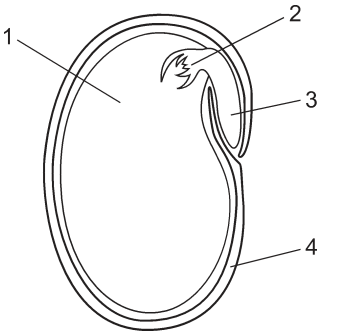


Which **two** parts of the flower produce haploid gametes?

A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 4

[N20/P1/Q33]

22. The diagram shows a section through a non-endospermic seed.

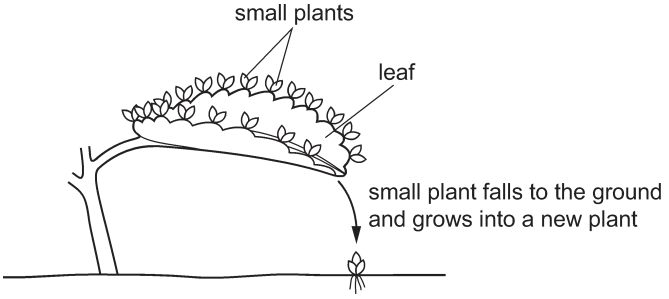


Which structures develop into the adult plant?

A 1 and 2 **B** 1 and 4
C 2 and 3 **D** 3 and 4

[N20/P1/Q34]

23. The diagram shows part of a *Bryophyllum* plant.



Which best describes how the new plants are produced?

	type of reproduction		type of cell division	
	asexual reproduction	sexual reproduction	meiosis	mitosis
A	✓	×	✓	×
B	✓	×	×	✓
C	×	✓	✓	×
D	×	✓	×	✓

key
✓ = yes
× = no

[J21/P1/Q33]

MCQ Answers

20. C Cotyledon stores food in seed, radicle develops downward making a root, while plumule changes into a shoot.

21. C Number 2 is ovary where ovule is made. It contains ovum which is haploid. Number 4 is an anther having haploid pollen grains.

22. C Number 2 is a plumule of seedling which develops into shoot while number 3 is radicle making root of a plant.

UNIT 16.1 Reproduction in Plants

THEORY Section

Question 1

Fig. 3.1 shows a flowering head of wheat, and individual flowers before and after opening.

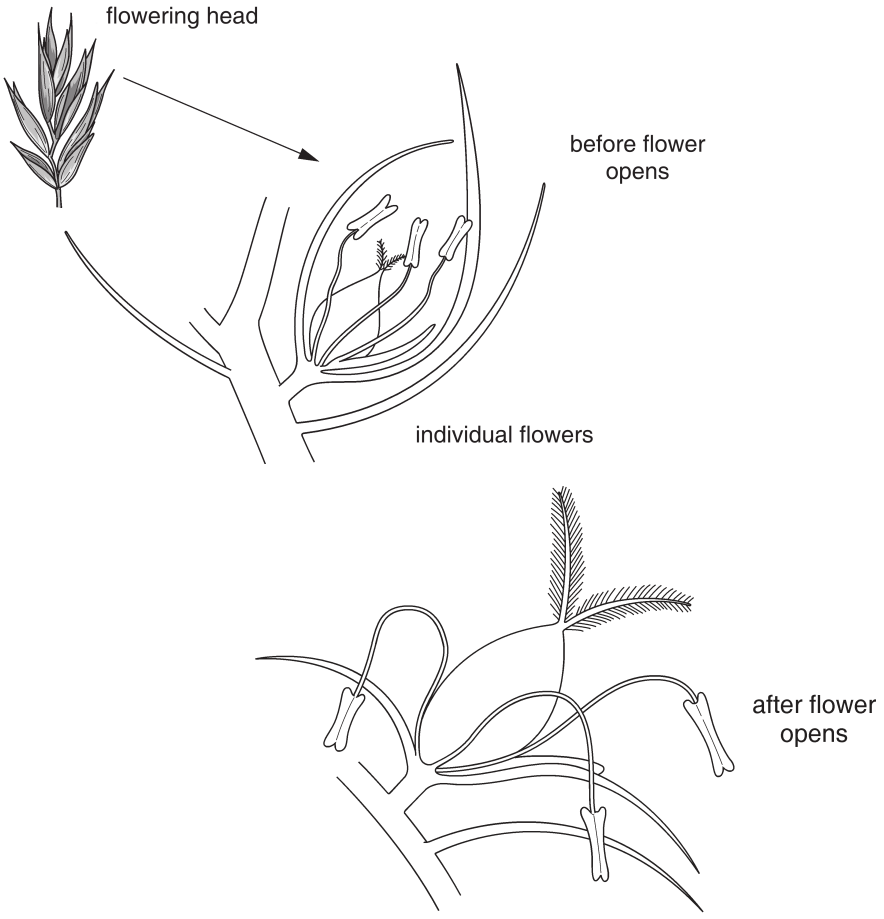


Fig. 3.1

The anthers release most of their pollen before the flower opens. The rest is released after the flower opens.

(a) Name the type of pollination found in the wheat plant before the flower opens. [1]

(b) (i) Using the information provided by Fig. 3.1, describe pollination in the wheat plant after the flower opens. [3]

(ii) Wheat pollen is relatively heavy and is released for only a few hours after the flowers open.
Suggest **two** disadvantages of this. [2]

[J14/P2/Q3(a,b)]

Solution

(a) Self pollination

(b) (i) After the flower opens, pollen grains are carried by wind to stigma of another flower of some other wheat plant. So such type of pollination is called as cross pollination.

(ii) Wind cannot carry pollen too far as it is heavy so it reduces dispersal. During the short period when wheat pollen is released, wind may not be blowing and it reduces the chance of pollination and fertilization.

COMMENT on **ANSWER**

"**(b)** **(ii)** Wheat depends too much on self pollination which causes lack of genetic variation. "

Question 2

(a) Describe the differences between an ovule, a seed and a fruit. [6]

(b) Explain how fruits or seeds may be modified for dispersal by wind. [4]

[N14 / P2 / Q6]

Solution

(a) Ovule: It is found in ovary of flower. It contains female gamete or ovum which is haploid, i.e., has one set of chromosomes (n).

Seed: Ovule develops into seed after fertilisation. It is diploid and usually found inside the fruit. It grows larger than ovule. It contains stored food material like starch, lipids etc. in endosperm or cotyledons. Apart from stored food, it contains embryo from which radicle and plumule are formed. It is surrounded by seed coat or testa.

Fruit: It consists of seeds surrounded by ovary wall or fruit wall called pericarp. Seeds and fruits are dispersed by wind, water and animals.

(b) Many seeds are dry and hence light in weight. Some may be winged, hairy, feathery while others are like parachute or helicopter. They have large surface area. Wind usually easily detach seeds or fruits from parent plant. Due to wind, it is taken far away which delays its descent. While away from parent plant it germinates in more favourable environment with less competition for soil, water and minerals.

COMMENT on **ANSWER**

"**(b)** If seeds fall near or below the parent plant, then many plants can grow at same place. It causes more competition among plants for absorbing water and minerals. Also less sunlight falls on these plants. So growth is retarded. "

Question 3

(a) For a **named** fruit or seed, describe how it is adapted for animal dispersal. [4]

(b) A student planted seeds from different types of plant in the same area of soil.

(i) Suggest why some of the seeds did not germinate. [2]

(ii) Explain why several of the seedlings were unable to survive after a few weeks. [4]

[J15 / P2 / Q6]

Solution

(a) Animals eat cereal crops including seeds, e.g. a cow, buffalo, goat, sheep etc. are herbivore animals which are adapted to taste of cereal seeds as well as green colour of plant leaves. Seeds of millet, sorghum, corn etc. are eaten which move through intestine of cattle. Due to defaecation, such animals release seeds to long distances from the parent plant at another location.

COMMENT on **ANSWER**

"**(a)** Some fruits or seeds are hooked, so animal's fur sticks to such seeds, which may fall off at some distance. "

(b) (i) Some seeds may be dormant, so are not viable. During dormancy period, seeds do not germinate. Temperature may not be suitable for germination or amount of water in soil is not enough. Some seeds may require light and suitable pH of soil.

(ii) If more seeds germinate, then there is competition and few seedlings do not survive. Competition occurs for factors like light, water and nutrients. If there is no favourable temperature or soil pH, then seeds, cannot continue growth after being germinated. Infections or diseases may also occur. Some soils may have toxins which damage or kill the seedlings.

COMMENT on **ANSWER**

"**(b) (i)** Mostly seeds require darkness for germination but few may be exceptions, so require light.

(ii) Overcrowding leads to competition for nutrients and other factors. Some seedlings are also eaten by herbivores, pests or insects which damage the crops."

Question 4

Fig. 1.1 shows a carpel of a flower with two pollen grains on top.

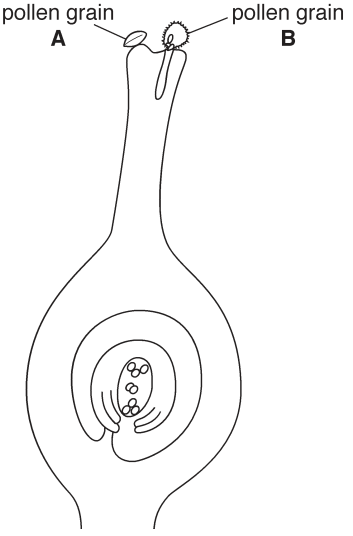


Fig.1.1

(a) Name each of the following:

(i) the process that has brought the pollen grains to the carpel [1]

(ii) the part of the carpel to which the pollen grains are attached. [1]

(b) On Fig. 1.1, draw a line to show the route taken by the pollen tube up to the point at which male and female gametes fuse. [3]

(c) Name each of the following:

(i) a part of the carpel where the nuclei are all **diploid** [1]

(ii) a part of the carpel that contains **haploid** nuclei. [1]

(d) Suggest why pollen grain **A** has not developed a pollen tube. [1]

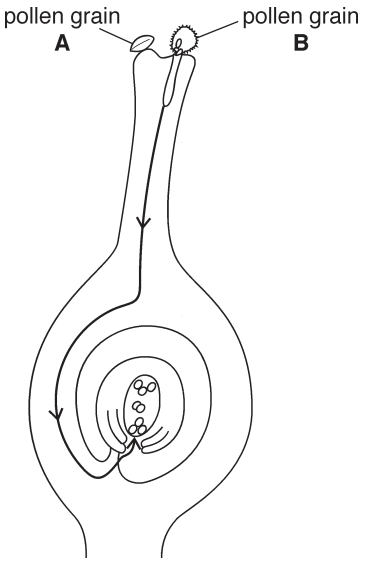
[N15 / P2 / Q1]

Solution

(a) (i) Pollination

(ii) Stigma

(b)



(c) (i) Stigma / style / ovary wall

(ii) Ovary / ovule

(d) Pollen grain may be from a different species or different kind of plant. Chemicals on stigma may not be suitable for developing pollen tube.

COMMENT on **ANSWER**

"**(b)** Draw a line continuing down style, entering micropyle and touching or entering embryo sac.

(c) (ii) One may write embryo sac / ovum / ova / egg cell / gamete.

(d) Pollen grain A couldn't germinate, as it was not viable or infertile. Pollen grain may have not been there long enough or it is immature. Wrong concentration of sugar in receptive juice of stigma or toxic chemicals may stop its germination. "

Question 5

(a) Outline the processes of *mitosis* and *meiosis*, including references to where they occur. [7]

(b) Describe the advantages of asexual reproduction in plants with reference to a **named** commercially important application. [3]

[N15 / P2 / Q9]

Solution

(a) Both mitosis and meiosis are processes leading to cell division. Mitosis occurs in somatic cells or body cells. It is needed for growth and development of body. Repair and replacement of worn out tissues occurs by mitosis. Cells produced by mitosis retain same chromosome number. Asexual reproduction by single parent produces offsprings in certain organisms by mitosis. Daughter cells produced are identical copy of parent cell, i.e. genetically similar. In sexually reproducing organisms, once zygote is formed, then rest of body cells are made by mitosis. Meiosis occurs in ovule of ovaries and anthers in plants. In animals, it occurs in ovaries and testes. It leads to sex cell production or gametes. Meiosis is reductional division by which chromosome number is halved and cells produced become haploid. Sexual reproduction depends upon meiosis. Meiosis leads to formation of 4 cells or gametes which are genetically different.

(b) By asexual reproduction, always an exact or similar copy with known characteristics of an organism is formed. In many plants, it can be conducted in controlled conditions in a green house environment, so that outcome is more certain. Only one parent is needed so it is not reliant on pollination by other agent or parent. In crop plants, cuttings, micro-propagation and tissue culturing can be done to produce less expensive, higher yielding, more number of offsprings which give greater profit.

COMMENT on **ANSWER**

"**(a)** Human cell chromosome number is $2n = 46$, which is constant in all body cells due to mitosis, but in gametes, i.e. sperms and ova, it reduces to half due to meiosis.

(b) Tubers, bulbs, layering and runners techniques, all involve asexual reproduction. Some haploid organisms also give rise to haploids by asexual reproduction. "