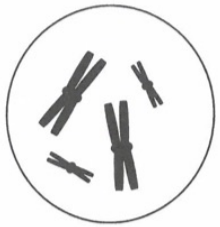
Directions: Questions 4 and 5 refer to the diagram below, which shows the appearance of chromosomes in a cell at the early stage of meiotic cell division.

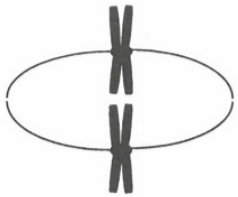


4. What is the chromosome number in the somatic cells of this organism?

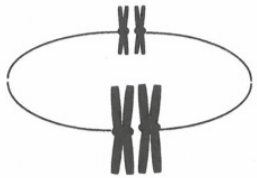
A. 2
B. 4
C. 8
D. 16

5. Which of the following diagrams correctly shows the arrangement of chromosomes found at a later stage of the cell division?

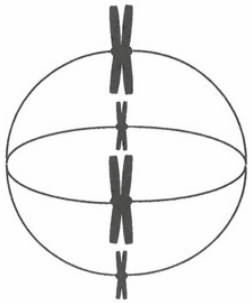
A.



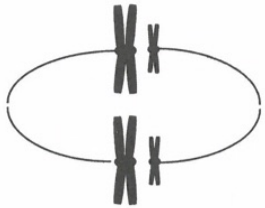
B.



C.



D.



DSE M.C. Questions - Cell division and Reproduction
(sort by difficulty)

Challenging

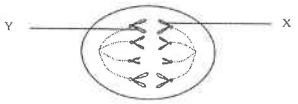
2012 Q.24 (37%)

Which of the following descriptions about pollen grains is correct?

A. Pollen grains are the male gametes of a plant.
B. Pollen grains can produce nectar to attract insects.
C. Pollen grains germinate when they land on the stigma of the same species.
D. Pollen grains of insect-pollinated flowers are usually smaller than those of wind-pollinated flowers.

2013 Q.18 (32%)

The diagram below shows a dividing cell which is forming an animal's egg cell:

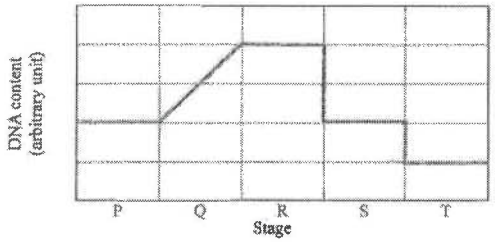


What conclusion about the cell division can be drawn from the diagram?

A. The diagram shows a mitotic cell division.
B. The diagram shows the first meiotic cell division.
C. X and Y are homologous chromosomes.
D. Each daughter cell will have four chromosomes.

2016 Q.19 (34%)

Directions: Questions 18 to 20 refer to the graph below, which shows the change in the DNA content of a cell undergoing a certain division:



Which of the following stages best represent(s) interphase?

A. P only
B. Q only
C. P and Q only
D. P, Q and R only

Challenging

2016 Q.32 (30%)

Structure Y serves as

(1) food store for seed germination.
(2) attraction to animals for seed dispersal.
(3) cushion to protect the seed during falling.

A. (1) only B. (2) only C. (1) and (3) only D. (2) and (3) only

Average

2012 Q.28 (58%)

Which of the following pairs of reproductive structures in humans and flowering plants have the same function?

	Humans	*Flowering plants*
A.	sperm	anther
B.	penis	pollen tube
C.	uterus	carpel
D.	vagina	petal

2012 Q.29 (46%)

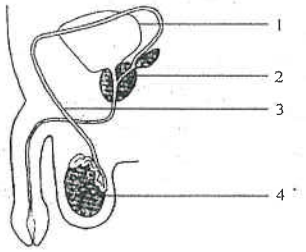
Which of the following is ***not*** a secondary sexual characteristic of a man?

A. growth of beard
B. production of sperms
C. broadening of shoulders
D. enlargement of larynx

Average

2013 Q.36 (55%)

Directions: Questions 35 and 36 refer to the diagram below, which shows the reproductive system of a man:



Which of the following may still occur after structure 3 on the both sides of the body has been tied up and cut?

(1) production of sperms
(2) erection of penis
(3) ejaculation

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

2014 Q.4 (41%)

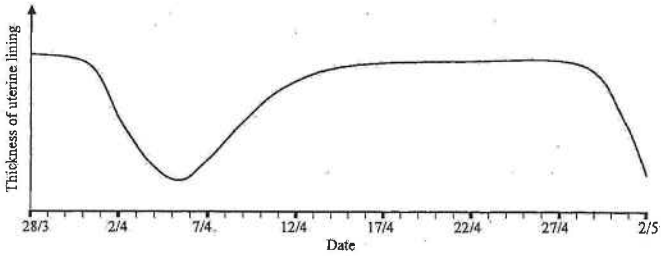
Which of the following correctly describes binary fission of the protist?

A. The amount of organelles in the daughter cell is the same as that in the mother cell.
B. The number of chromosomes in the daughter cell is half of that in the mother cell.
C. The alleles found in the daughter cells are different from each other.
D. The sizes of the daughter cells are similar to each other.

Average

2014 Q.28 (53%)

The diagram below shows the changes in the uterine lining of a woman:



During which of the following periods would the woman most likely get pregnant after copulation?

A. 28/3 to 1/4
B. 4/4 to 8/4
C. 11/4 to 15/4
D. 18/4 to 21/4

2015 Q.19 (40%)

Which of the following can be the functions of roots in flowering plants?

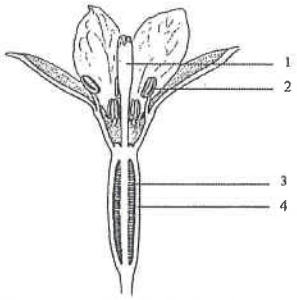
(1) anchorage
(2) absorption
(3) vegetative propagation

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Average

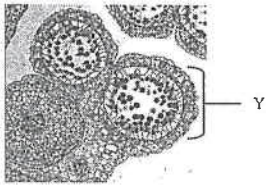
2015 Q.25 (64%)

Directions: Questions 24 and 25 refer to the diagram below, which shows the structures of a flower:



The photograph below shows the cross section of structure 2.

Which of the following parts of the human reproductive system serves a function similar to that of Y?



A. ovum
B. sperm
C. testis
D. ovary

Average

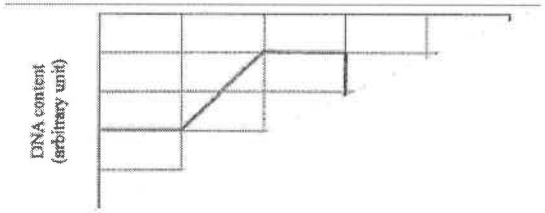
2015 Q.26 (42%)

During pregnancy, amniotic fluid containing foetal cells can be obtained for karyotyping. This helps to determine whether the foetus

(1) is male or female.
(2) has Down syndrome or not.
(3) is a carrier of Sickle-cell anaemia.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

Directions: Questions 18 to 20 refer to the graph below, which shows the change in the DNA content of a cell undergoing a certain division:



2016 Q.18 (67%)

Which of the following can be deduced from the graph?

(1) There are two divisions.
(2) There is one DNA duplication.
(3) DNA content is halved at the end of the whole process.

A. (1) and (2) only B. (1) and (3) only C. (2) and (3) only D. (1), (2) and (3)

2016 Q.20 (59%)

Sister chromatids separate from one another during the transition from

A. P to Q. B. Q to R. C. R to S. D. S to T.

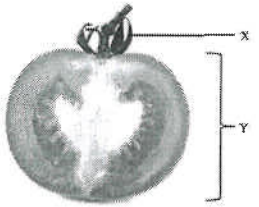
Average

2016 Q.31 (70%)

Directions:

Questions 31 and 32 refer to the diagram below, which shows the section of a fruit:

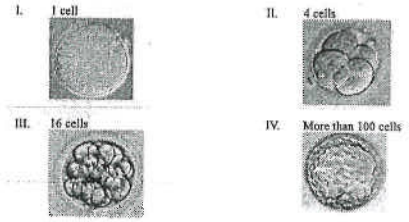
Which of the following combinations correctly shows the floral parts that develop into structures X and Y?



	X	*Y*
A.	carpel	petal
B.	carpel	ovary
C.	sepal	petal
D.	sepal	ovary

Directions:

Questions 21 to 23 refer to the following photomicrographs of the same magnification. The photomicrographs show some early stages of embryo development:



2017 Q.21 (53%)

Which of the following processes are taking place from stage I to stage IV?

(1) cell division
(2) cell enlargement
(3) cell differentiation

A. (1) and (2) only B. (1) and (3) only C. (2) and (3) only D. (1), (2) and (3)

2017 Q.22 (63%)

How many cell cycles has the cell in stage I gone through to reach stage III?

A. 2 cycles B. 3 cycles C. 4 cycles D. 5 cycles

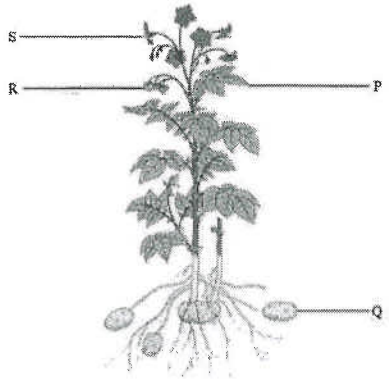
2017 Q.23 (49%)

Which of the following stages is ready for implantation?

A. I B. II C. III D. IV

Average

Directions: Question 15 to 17 refer to the following diagram, which shows the structures of a potato plant:



2018 Q.15 (61%)

Which of the following labelled structure(s) is / are involved in the reproduction of this potato plant?

A. Q only B. S only C. R and S only D. Q, R and S only

2018 Q.16 (51%)

Which of the following labelled structures contain cells with different genotypes?

A. P and Q B. P and S C. Q and R D. R and S

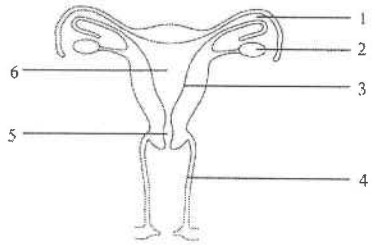
2018 Q.17 (59%)

Farmers usually grow potato plants by vegetative propagation. This is probably because vegetative propagation

A. Produces tubers for harvesting
B. Does not involve seed dispersal
C. Takes a shorter time to reproduce
D. Allows rapid colonization of an area

Easy

Directions: Questions 25 and 26 refer to the following diagram, which shows part of the female reproductive system:



2012 Q.25 (93%)
Which of the following structures undergo periodic changes?
A. 1 and 3 B. 1 and 4 C. 2 and 3 D. 2 and 4

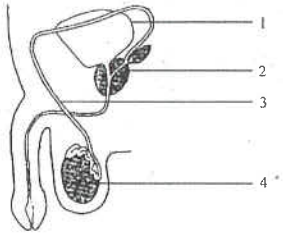
2012 Q.26 (82%)
In which of the following structures does implantation normally take place?
A. 1 B. 3 C. 5 D. 6

2012 Q.27 (79%)
Which of the following contraceptive methods prevents the formation of mature gametes?
A. using diaphragm
B. using rhythm method
C. intake of contraceptive pills
D. using intrauterine device

2013 Q.14 (80%)
Which of the following consists of individuals that are genetically different from each other?
A. Seeds of the same fruit
B. Stigmas of the same flower
C. Petals of the same plant
D. Buds of the same tuber

Easy

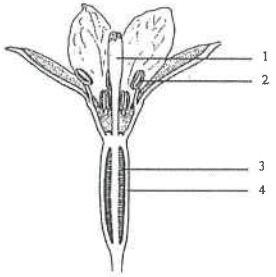
2013 Q.35 (90%)
Directions: Questions 35 and 36 refer to the diagram below, which shows the reproductive system of a man:



Which of the following structures are involved in the production of the content of semen?
A. 1 and 3 B. 1 and 4 C. 2 and 3 D. 2 and 4

2014 Q.29 (78%)
During foetal development, the placenta has functional roles similar to
(1) the bone.
(2) the lungs
(3) the small intestine.
A. (1) and (2) only B. (1) and (3) only C. (2) and (3) only D. (1), (2) and (3)

2015 Q.24 (78%)
Directions: Questions 24 and 25 refer to the diagram below, which shows the structures of a flower:

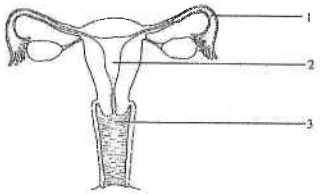


Which structure will develop into the fruit wall?

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

Easy

Directions: Questions 19 and 20 refer to the diagram below, which shows some structures of the female reproductive system in humans:



2017 Q.19 (78%)

Which of the following combinations correctly shows the location where fertilization and discharge of semen normally take place?

	Fertilisation	*Discharge of semen*
A.	1	2
B.	1	3
C.	2	2
D.	2	3

2017 Q.20 (76%)

If location 1 is blocked in a 14-year-old girl, which of the following is most likely to occur?

A. There is no ovulation.
B. Her fertility decreases.
C. There is no menstruation.
D. Her breasts fail to develop.

2019 Q.12 (87%)

Which of the following statements about the human egg and sperm is correct?

A. Both have the same number of genes.
B. Both have the same amount of cytoplasm.
C. Both have the same amount of food reserve.
D. Both have the same number of chromosomes.

2020 Q.21

21. In flowering plants, asexual reproduction is considered less favourable than sexual reproduction in terms of natural selection because offspring produced from asexual reproduction

A. are genetically identical to each other.
B. have keen competition with each other.
C. cannot invade and colonise new environments.
D. can grow rapidly only in favourable conditions.

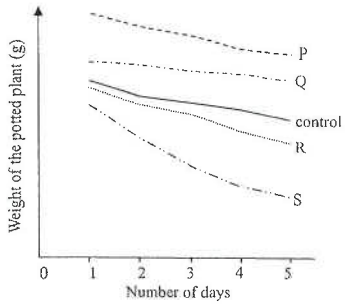
2020 Q.25

25. Which of the following descriptions of floral structures is correct?

A. The ovule forms seeds.
B. The ovary forms seed coats.
C. Pollen grains are male gametes.
D. The filament contains pollen grains.

2021 Q.30,31,22,21

Directions: Questions 30 and 31 refer to the graph below, which shows the effect of environmental conditions on the transpiration rate of a potted plant placed in a small room. The weight of the potted plant was recorded daily at noon for five consecutive days (control experiment). The experiment was repeated by changing one of the environmental conditions: increased light intensity, increased air current, increased relative humidity, or increased temperature.



30. Which of the following lines represents the results with an increased relative humidity?

A. P
B. Q
C. R
D. S

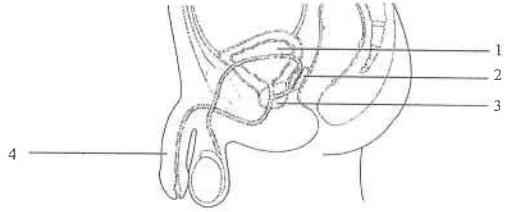
31. In the above study, which of the following steps is necessary?

A. Remove any fallen leaves.
B. Wrap the pot with a plastic bag.
C. Water the plant every day in the morning.
D. Smear vaseline on the lower epidermis of the leaves.

22. With reference to structure 4 above, which of the following structures of flowering plants has a similar function?

A. style
B. anther
C. filament
D. pollen tube

Directions: Questions 21 and 22 refer to the diagram below, which shows the male reproductive system and its associated structures:



21. Which of the labelled structures are responsible for producing seminal fluid?

A. 1 and 2 only
B. 1 and 3 only
C. 2 and 3 only
D. 1, 2 and 3

Answers

Challenging

2012	2013	2016
24 [C]	18 [D]	19 [C]
		32 [B]

Average

2012	2013	2014	2015	2016	2017	2018
28 [B]	36 [D]	4 [D]	19 [D]	18 [D]	21 [B]	15 [D]
29 [B]		28 [C]	20 [D]	20 [D]	22 [C]	16 [D]
			31 [D]	31 [D]	23 [D]	17 [C]

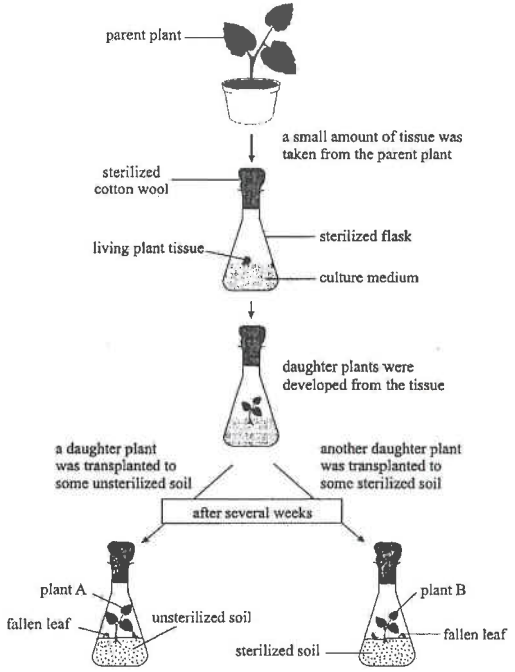
Easy

2012	2013	2014	2015	2017	2019
25 [C]	14 [A]	29 [C]	24 [D]	29 [B]	12 [D]
26 [B]	35 [D]			20 [B]	
27 [C]					

2020
21[A]
25[A]

CE - 2002

1. (a) Some plants can be propagated vegetatively using tissue culture. In this method, the culture medium is sterilized before use and it provides essential materials for plant growth. The diagram below shows an outline of an investigation involving tissue culture. The whole process is conducted in the presence of light.



(i) Sugar is one of the essential components of the culture medium. Explain why sugar must be added. (3)

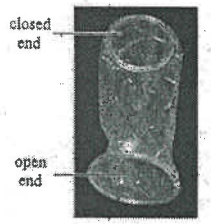
(ii) Compare the genetic make-up of the daughter plants with that of the parent plant. Give a reason for your answer. (2)

(iii) After several weeks, plant B showed signs of yellowing while plant A remained green. Based on the information provided, suggest an explanation for the yellowing of plant B. (3)

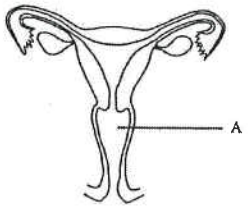
(iv) Give two advantages of this method of plant propagation over the propagation using seeds. (2)

CE - 2002

2. (a) The following photograph shows a female condom while the diagram on the right shows the human female reproductive system:



Female condom



Female reproductive system

(i) The female condom is placed in A during sexual intercourse. How does the female condom contribute to contraception? (2)

(ii) Give an example of an infectious disease that can be prevented by wearing the condom. (1)

(iii) Another contraceptive method is to tie and cut both the oviducts. State whether or not menstruation will still occur in a young woman who has received this operation. Explain your answer with reference to the physiological processes involved. (4)

(iv) The following is a simplified diagram of a cell which is undergoing cell division to form an ovum.

(Only two pairs of homologous chromosomes are shown in the diagram.)

Based on the above diagram, make a drawing of the ovum formed showing the chromosomes contained inside. (3)

CE - 2003

2. (b) The cartoon below shows a foetus crying for help inside the mother's body:

(i) Smoking during pregnancy is hazardous to the foetus. The foetus may be affected in a number of ways, such as a reduced supply of oxygen and the entry of toxic chemicals.

(1) Suggest an explanation for the reduced oxygen supply to the foetus. (2)

(2) Using a flowchart, show the route by which nicotine in cigarette smoke is transported from the mother's lung to the foetus. Indicate only the major organs and blood vessels involved. (3)

(ii) (1) An early sign of the birth process is the breaking of the amnion. What is the significance of this event in the birth process? (2)

(2) Describe what happens afterwards that leads to the birth of the baby. (3)

CE - 2004

2. (a) The table below shows the average number of pregnancies for women adopting different contraceptive methods :

Contraceptive method	Pregnancies per 100 women in 12 months
Condom	15
Diaphragm	13
Intra-uterine device (IUD)	2
Rhythm method	25

(i) The use of condoms and diaphragms are based on the same principle in bringing about contraception. What is this principle? (1)

(ii) How can an IUD prevent pregnancy to occur? (1)

(iii) (1) Explain the biological basis of the rhythm method. (3)

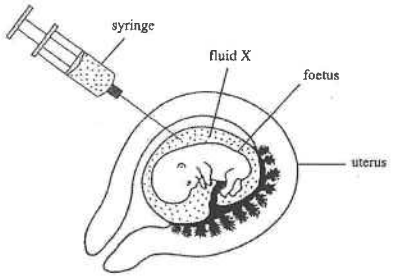
(2) Why does this contraceptive method have a high rate of failure? (1)

(iv) Even though some couples do not use any contraceptive methods and have regular intercourse, the wives fail to become pregnant. Suggest two reasons for this. (2)

(v) A man received an operation for contraception and had his sperm ducts tied and cut. Explain why his secondary sexual characteristics will not be affected after this operation. (3)

CE - 2005

10. (a) The diagram below shows how the fluid surrounding the foetus (fluid X) can be collected using a syringe. The fluid collected contains some foetal cells. These cells are cultured for several weeks and then examined under the microscope to determine whether the foetus has certain genetic disorders.



(i) (1) Name the membrane that surround fluid X. (1)

(2) Give two reasons why fluid X is important to the foetus during its development. (2)

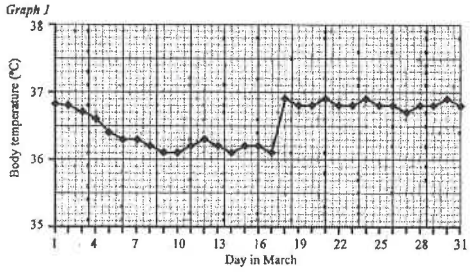
(ii) Suggest why it is necessary to culture the foetal cells for several weeks before they are examined under the microscope. (1)

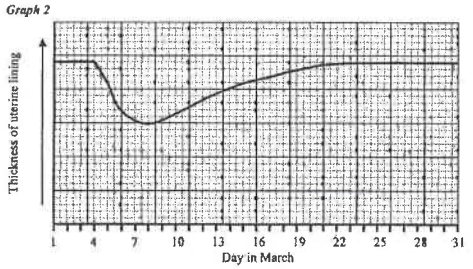
(iii) If microscopic examination shows that the foetus has Down Syndrome, the parents will have to decide whether to continue with the pregnancy or to end the pregnancy by abortion. Which choice do you support? Justify your answer. (2)

(iv) Explain how we can find out the sex of the foetus through microscopic examination of the cultured cells. (2)

CE - 2006

7. Lily is a healthy young woman. She adopts the 'safe period' method for contraception. In order to do so, she measures her body temperature every morning when she wakes up. Graph 1 below shows the body temperature recorded in March and Graph 2 shows the change in the thickness of her uterine lining in the same month:





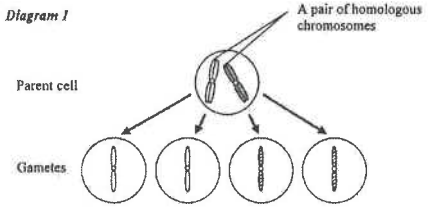
(a) Identify the period that corresponds to menstruation. Give one piece of evidence from the information provided to support your answer. (2)

(b) Referring to the graphs, state the period in which there will be a high chance of pregnancy if sexual intercourse occurs. Explain your answer. (4)

(c) The 'safe period' method is not very reliable for contraception because it can only predict part of the fertile period. Explain why it cannot predict the whole fertile period.(2)

CE - 2006

8. (b) Diagram 1 below shows the result of meiotic cell division in gamete formation in humans: (Note : Only one pair of homologous chromosomes is shown.)

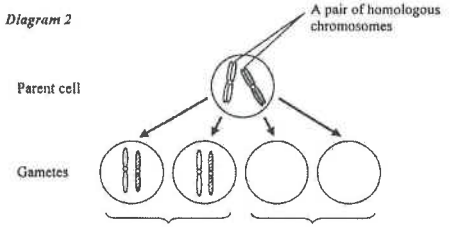


(i) Based on Diagram 1, give two features that are characteristic of meiotic cell division. (2)

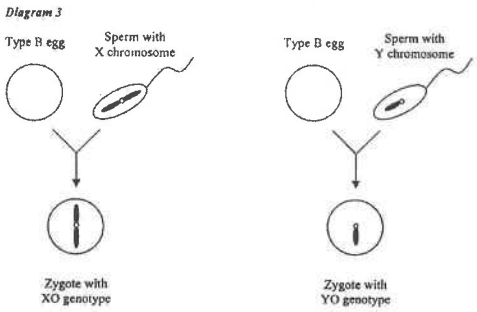
(ii) Sometimes, an abnormality occurs during meiotic cell division in gamete formation in humans. Diagram 2 below shows the abnormality concerning a pair of homologous chromosomes :

(1) Distinguish between type A and type B gametes. (1)

(2) Name a genetic disorder that will develop if a type A egg is fertilized successfully by a normal sperm. (1)



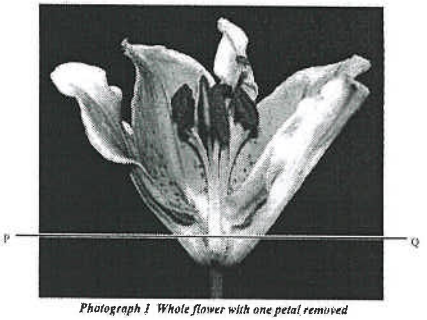
(3) This type of abnormality in cell division may occur in the sex chromosomes. The type B eggs may fertilize with normal sperms to form zygotes with different genotypes as shown in Diagram 3 below: (Note: Only the sex chromosome is shown.)



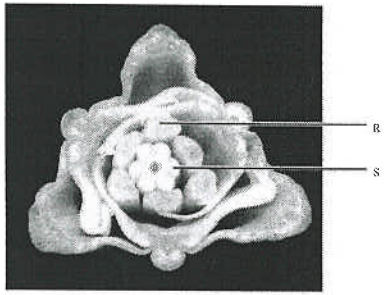
Suggest why zygotes with XO genotype may develop into an individual but not those with YO genotype. (3)

CE - 2007

8. (a) The photographs below show the structure of a lily flower:



Photograph 1 Whole flower with one petal removed



Photograph 2 Cross section at PQ (enlarged)

(i) Label the following structures: (2)

R:_____

S:_____

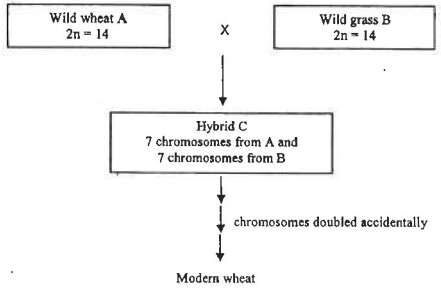
(ii) State the method of pollination for this flower. Support your answer with two observation features from Photograph 1. (3)

(iii) After pollination, describe how the male gamete meets the female gamete. (4)

(iv) The lily plant can also reproduce asexually. What is this type of asexual reproduction? (1)

CE - 2008

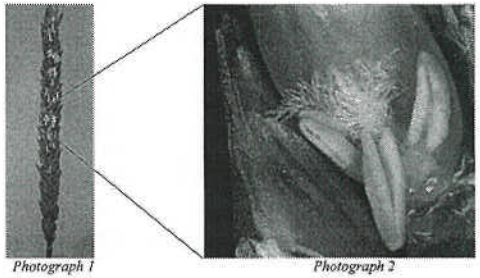
9. (a) A study of the wheat genome reveled that modern wheat is originated from the crosses among wild wheat and wild grasses. Below is one of the crosses.



(i) Hybrid C cannot produce gametes but it can produce offspring asexually. State the type of asexual reproduction employed by hybrid C. (1)

(ii) With reference to the process of meiotic cell division, suggest why hybrid C cannot produce gametes. (2)

(iii) The following photographs show the reproductive structures of wheat.



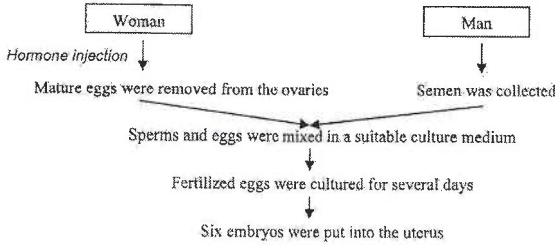
Photograph 1 *Photograph 2*

(1) What is the pollinating agent for wheat? Support your answer with two observable features from photograph 2. (3)

(2) A scientist performed a genetic experiment by crossing two different wheat plants. Describe the procedures done in order to ensure cross-pollination, but not self pollination to occur. (3)

CE- 2009

8. (b) A couple can produce gametes but are still not able to produce children. A doctor advised them to undertake an *in vitro* fertilization treatment. The chart below outlines the stages involved in their *in vitro* fertilization treatment.



(i) Suggest *one* possible cause of infertility for this couple. (2 marks)
The man and the woman.

(ii) Explain why the woman had to undertake hormone injection at the beginning but not the man. (3 marks)

(iii) Of the six embryos put into the uterus, eventually only two embryos have successfully developed.

(1) Why were some embryos not able to develop in the uterus? (1 mark)

(2) Is it possible that the two embryos are of different sexes? Explain your answer. (2 marks)

AL - 2002 2B

4. (b) Describe how the mammalian foetus obtains amino acids from proteins in the maternal diet. (5)

AL - 2004 1A

8. (a) The diagram below shows a mammalian sperm with its mitochondria localized in the region shown:

(i) Relate the location of the mitochondria to their function. (2)

(b) It is known that the nuclei from two sperms of the same individual can be made to combine inside an anucleate ovum (ovum without nucleus) to form a diploid cell which can further develop into an embryo. Explain the sex(es) of the embryo that can be produced by this method.(2)

AL - 2006 2B

4. (a) During sexual reproduction in humans, sperms are transferred from the penis to the vagina, whereas in terrestrial flowering plants, pollen grains are transferred from the anther of the flower to the stigma. Contrast the processes involved in the transfer of sperms and pollen grains mentioned above, and the subsequent fusion of the male and female gametes. (10)

DSE-2012 1B

11. Mitosis and meiosis are important processes that ensure the continuity of life. Contrast the two processes and state the significance of their differences. (11 marks)

DSE-2014 1B

3. Before the early 20th century, scientists generally held the belief:

"Cell division resulted in the loss of genetic material so that each cell in a multicellular organism would contain only the genetic material specific to its particular cell type."

In 1902, Hans Spemann performed one of the earliest experiments on animal cloning. He used a fine hair to separate the cells of a two-celled amphibian embryo, and found that each cell was able to develop into a complete organism.

(a) Why did Spemann's experiment disprove the early belief about cell division? (1 mark)

(b) Elaborate on how the above example can be used to demonstrate the two aspects of the nature of science listed in the table below. (2 marks)

Nature of Science	*Elaboration*
Scientific knowledge is tentative and subject to change.	
Interpretation of observations is guided by our prior understanding of other theories and concepts.	

(c) Using the current understanding about cell division, explain how genetic material is preserved in mitosis. (3 marks)

DSE-2014 1B

8. A primrose plant is a flowering plant that has two different types of flowers. Photograph I and Photograph II show the appearances of the two types of flowers (P and Q) and Photograph III and Photograph IV show the sections of the flowers respectively. Each primrose plant produces either type P flowers or type Q flowers.

(a) Apart from the presence of nectarines, give *two* observable features of type P flowers which support the claim that the primrose is an insect-pollinated plant. (2 marks)

(b) Butterflies collect nectar from flowers using a mouth structure in the form of a long sucking tube.

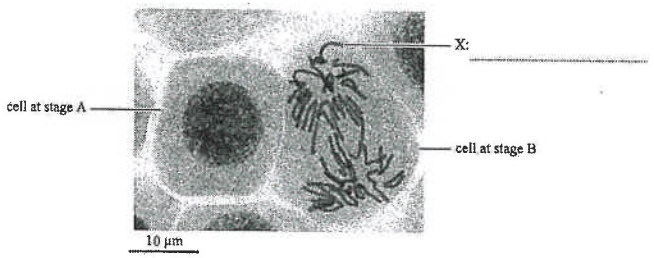
(1) When a butterfly visits a type P flower, which part of the sucking tube will the pollen grains stick to? (1 mark)

(2) When the same butterfly visits another flower, which type of flower will be more readily pollinated? Why? (2 marks)

(3) What is the advantage of having the different positioning of anthers and stigmas in the primrose? (2 marks)

HKDSE – 2015 1B

2. The photomicrograph below shows the appearance of genetic materials at two different stages of the cell cycle:



(a) Label structure X shown in the photomicrograph. (1 mark)

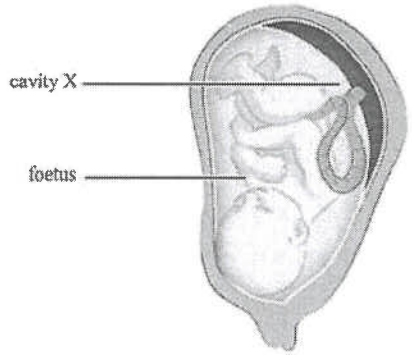
(b) With reference to the appearance of the genetic materials shown in the photomicrograph, at which stage, A or B, is transcription more likely to take place? Explain your answer. (2 marks)

(c) In the space provided below, state the cause for the different outcomes of mitosis and meiosis. (2 marks)

	Outcome		*Cause*
	Mitosis	*Meiosis*	
Number of daughter cells	2	4	
DNA content in daughter cells	2N	1N	

HKDSE – 2016 1B

2. The following diagram shows a foetus and the associated structures inside the uterus:

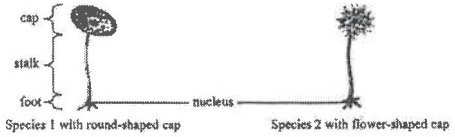


(a) What is the fluid found in cavity X? (1 mark)

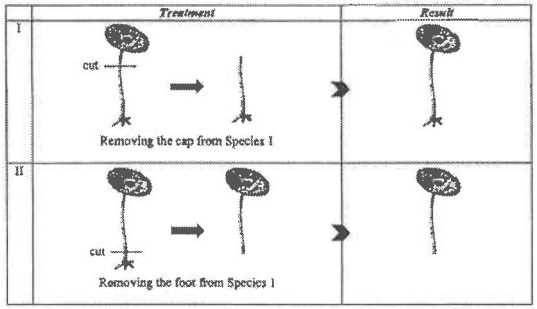
(b) On the diagram, label the structure where the exchange of materials between the foetal blood and maternal blood takes place. (1 mark)

(c) Give two reasons why foetal blood has to be separated from maternal blood.(2 marks)

8. In 1930s, a Danish biologist J. Hammerling tried to find out where the genetic information was stored inside the eukaryotic cell. He used some unicellular algae called Acetabularia to carry out a series of experiments. The diagram below shows the morphology oftwo species of algae used in his study:



He divided Species 1 into two groups, removing the cap from one group (I) and the foot from another group (II). He then observed if any regeneration occurred in the remaining parts. The diagram below shows the treatments and the results:

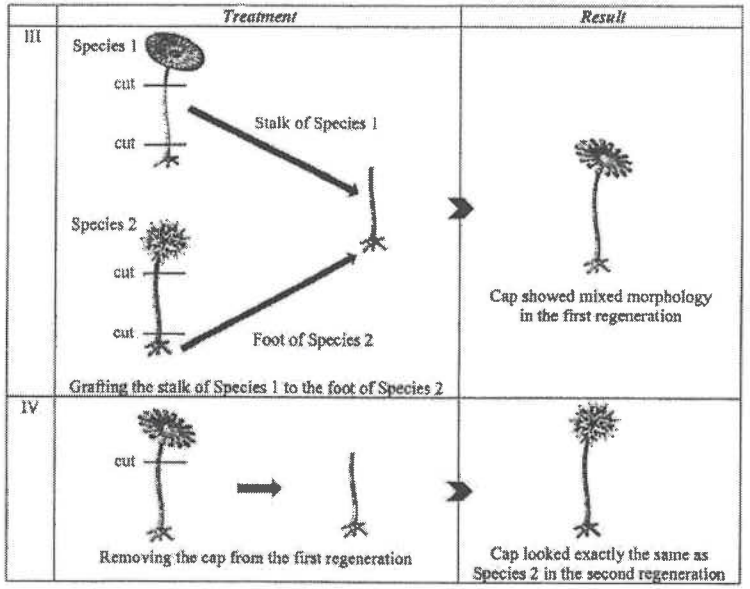


(a) Describe the results of the above experiment. (2 marks)

(b) Based on the results, Hammer ling hypothesized that:

The hereditary information is stored in the foot of the algal cell.

Hammerling further studied the expression of hereditary information by grafting the stalk of Species I to the foot of Species 2. After grafting, the cap formed from the first regeneration showed a mixed morphology (III). He then removed the regenerated cap. The cap formed from the second regeneration looked exactly the same as Species 2 (IV). The diagram below shows the treatments and the results:



(i) Hammerling concluded that when the cut stalk was transplanted, it contained some short-lived instruction derived from the foot of Species I, resulting in a mixed morphology of the cap in the first regeneration.

(1) Suggest the type of biomolecule that carried the short-lived instruction. (1 mark)

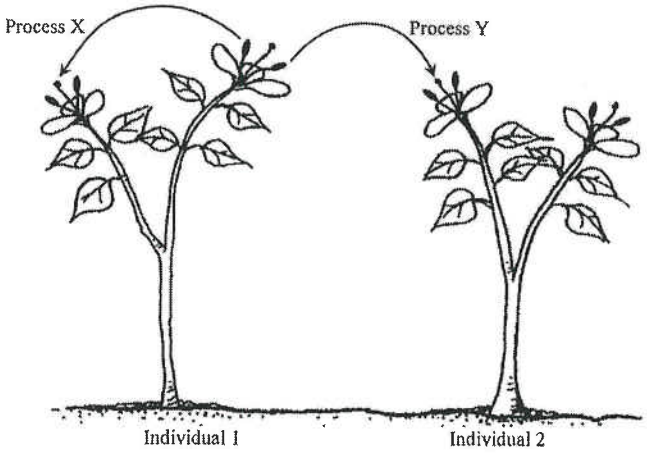
(2) How could the biomolecule suggested in (1) affect the morphology of the cap? (2 marks)

(ii) How do the results from this experiment support Hammerling's hypothesis? (2 marks)

(c) Give one aspect about the nature of science that can be demonstrated in the above discovery and give a reason to support your answer. (2 marks)

HKDSE - 2017 1B

3. The diagram below shows certain processes occurring in a species of flowering plant:



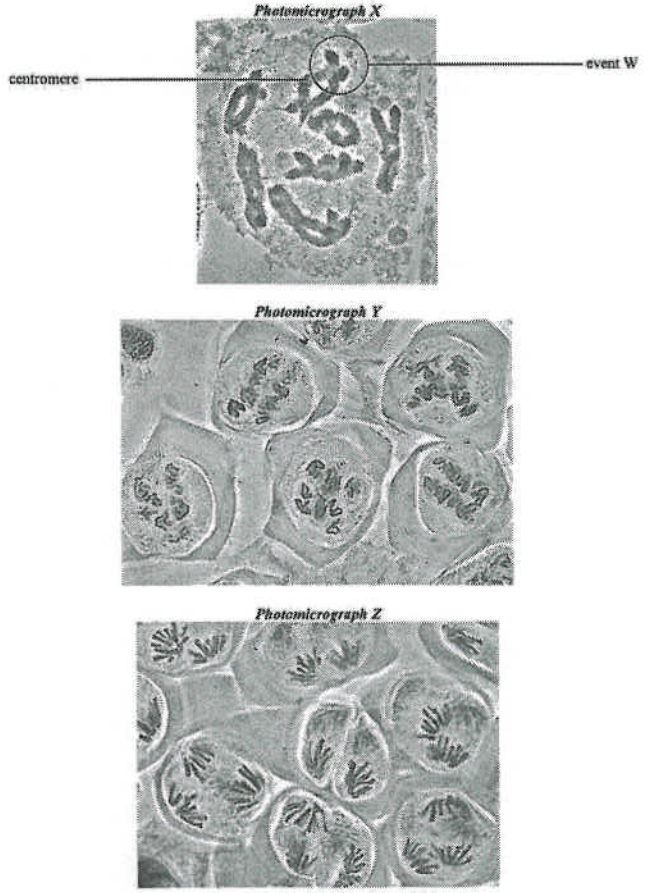
a. What is process Y? (1 mark)

b. Describe the sequence of events leading to fertilization after process Y has completed. (4 marks)

c. Explain briefly why process Y is better than process X in terms of evolution. (2 marks)

HKDSE - 2019 1B

3. The photomicrographs below show some stages of meiosis taking place in a flower:



(a) State *one* floral structure in which this type of division takes place. (1 mark)

(b) (i) Name event W shown in Photomicrograph X. (1 mark)

(ii) Briefly describe what happens in event W. What is the importance of event W? (2 marks)

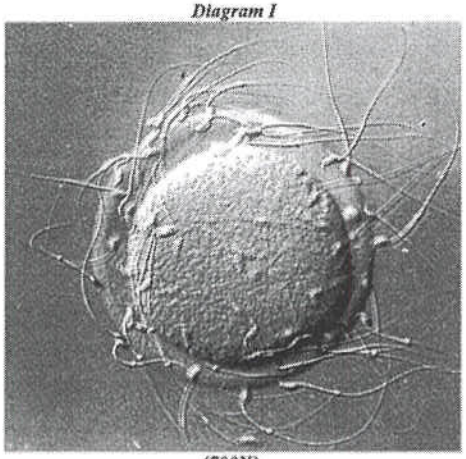
(c) (i) Which photomicrograph, Y or Z, shows the first meiotic division? Give a piece of evidence to support your answer. (2 marks)

(ii) What is the purpose of the first and second meiotic divisions respectively. (2 marks)

HKDSE - 20201B

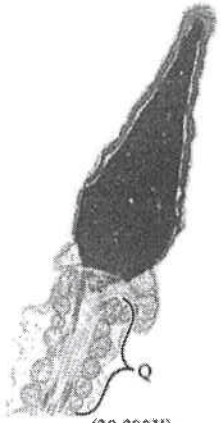
10. Diagram I shows a photomicrograph of human sperm and a human ovum during fertilisation while Diagram II shows an electron micrograph of an enlarged view of human sperm.

Diagram I



(700X)

Diagram II



(30 000X)

(a) Under normal circumstances, in which structure of the female reproductive system does the process shown in Diagram I take place? (1 mark)

(b) With reference to Diagram II, what is the significance of organelles Q to the sperm's function? (1 mark)

(c) (i) Explain the significance of the chromosome number of the sperm and ovum to sexual reproduction. (2 marks)

(ii) Briefly describe how identical twins may arise after fertilization. (2 marks)

HKDSE – 2021 1B

5. A student prepared cells of an onion root tip for observing cell division under a light microscope.

(a) What type of cell division is likely to take place in the root tip of an onion? Explain your answer. (2 marks)

(b) Suggest *one* necessary step to make the chromosomes observable under a light microscope. (1 mark)

(c) Some events of the cell division are randomly shown in the following photomicrographs:

V

W

X

Y

Z

(i) Starting with photomicrograph W, arrange the photomicrographs in the correct order to show the sequence of events in cell division. (1 mark)

W → ___ → ___ → ___

(ii) A normal onion root cell has 16 chromosomes. Complete the following table to show the number of chromosomes and chromatids in photomicrographs Y and Z. (2 marks)

Photomicrograph	Number of chromosomes	Number of chromatids
Y		
Z		

Past Papers Marking Scheme – Cell division and reproduction

CE - 2002 Q.1 (a)

(i) The plant tissue cannot carry out photosynthesis / produce its own sugar 1
So it needs an external supply of sugar for respiration to release energy 1
and as raw material for growth 1

(ii) The genetic make-up of the daughter plants was the same as that of the parent plant 1
because the daughter plants were formed by mitosis of the parent tissue cells 1

(iii) For plant B, the sterilized soil had no microorganism 1
for recycling the fallen leaves into minerals 1
After several weeks, the minerals in the soil became exhausted, so insufficient chlorophyll was made 1

(iv) This method is a faster / surer way of producing daughter plants 1
The desirable characteristics of the parent can be retained in the daughter plants 1

CE - 2002 Q.2 (a)

(i) It forms a physical barrier 1
to prevent sperms from meeting the ovum 1

(ii) AIDS / hepatitis B, C or E / gonorrhea / syphilis (accept other correct answers) 1

(iii) Menstruation will still occur 1
because the operation does not affect the production of the female sex hormone by the ovary 1
and the transport of the hormone by blood 1
Under the influence of the female sex hormone, the uterine lining will get thicker 1
and shed off later

(iv) Title (T) ½
Drawing including cell outline (D) ½
Two chromosomes shown i.e. haploid, chromosome as single thread 1+1

The ovum

CE - 2003 Q.2 (b)

(i) (1) Tar in cigarette smoke deposits on the surface of the air sacs in the mother's lungs 1
As a result, less oxygen can be absorbed into the mother's blood 1
Hence reducing the oxygen supply to the foetus

(2) (mother's lung) → pulmonary vein → heart → aorta → artery to uterus → placenta → umbilical vein → (foetus) 6 x ½
(no arrows, deduct 1 mark)

(ii) (1) This results in the discharge of the amniotic fluid 1
Which lubricates the passage of the foetus through the vagina 1

(2) The cervix continues to dilate 1
The uterus and the abdominal muscles contract strongly 1
to expel the foetus through the vagina 1

CE - 2004 Q.2 (a)

(i) Both of them are based on the use of a barrier / prevent the sperms from meeting the egg 1

(ii) IUD prevents the implantation of the embryo 1

(iii) (1) Egg and sperms are viable for only a few days once they are released 1
The rhythm method is to avoid having intercourse around the time of ovulation 1
so that sperms and egg will have no chance of meeting each other 1

(2) Because it is hard to predict the time of ovulation accurately 1

(iv) Time of intercourse does not necessarily fall in the period around ovulation
Gametes produced may not be viable / may be defective
Oviducts of some women may be blocked
The sperm count of the husbands is too low any two 1,1

(v) Because the development of secondary sexual characteristics is controlled by the male sex hormone 1
which is still produced by the testes 1
and transported in the blood after the operation 1

CE - 2005 Q.10 (a)

(i) (1) amnion 1

(2) Fluid X helps to protect the foetus from mechanical shock
It can prevent desiccation of the foetus
It allows movement of the foetus in the uterus
It can maintain a constant internal environment for the growth of the foetus
any two 1,1

(ii) To allow time for obtaining enough foetal cells for analysis 1

(iii) Continue with pregnancy: (accept other reasonable answers)
- the foetus has life; we have no right to terminate the life of an individual
- people with Down Syndrome can lead a quality and meaningful life
- abortion may have potential risk to the mother and may have psychological impact on the mother 1,1

End pregnancy: (accept other reasonable answers)
- the child may become a burden to his / her parents / society as it needs more care
- the child may be discriminated due to his physical / mental disabilities 1, 1
any one set

(iv) Under the microscope, if two X chromosomes are found / the sex chromosomes are identical, the foetus is a female 1
If an X and a Y chromosome are found / the sex chromosomes are different, the foetus is a male 1

CE - 2006 Q.7

(a) 4^{th} to 8^{th} March 1
There is a great drop in the thickness of the uterine lining in the blood 1

(b) 12^{th} to 21^{st} March 1
The rise in body temperature indicates that / Uterine lining is thickened and ready for implantation 1
ovulation occurs at around day 17 1
Also, sperms and the egg can survive for a couple of days in the female reproductive tract 1
If sexual intercourse occurs in this period, there is a high chance of pregnancy

(c) This method only allows her to detect ovulation when there is a rise in the body temperature 1
But it fails to predict the fertile period before ovulation 1

CE - 2006 Q.8 (b)

(i) Four daughter cells are formed from a single parent cell,
The two members of a pair of homologous chromosomes are separated; / each goes to a different daughter cell
Each daughter cell contains the haploid number of chromosomes Any two 1,1

(ii) (1) Type A gamete has both members of the homologous pair, while type B gamete has none of that homologous pair 1
(2) *Down / Down's syndrome 1
(3) The X chromosome carries more genes than the Y chromosome 1
Absence of the X chromosome will result in the loss of more genes/alleles that may be essential to the survival of the zygotes and its subsequent development 1 1

CE- 2006 Q.10 (a)

(i) The average dry mass of both samples decreases from day 0 to day 12 1
because the stored food in cotyledon / seed 1
is used in respiration / is broken down to carbon dioxide and water 1

(ii) The average dry mass of the seedlings grown in daylight increases from day 12 to day 18, while that of seedlings grown in darkness continues to decrease 1
because under daylight, the seedlings have developed green leaves 1
for photosynthesis 1
The rate of food production is faster than the rate of food consumption resulting a net gain in dry mass 1

(iii) The dry mass shows the actual biomass / organic matter of the seedlings /
The water content of the seedlings varies and hence the fresh mass cannot indicate the actual growth 1

CE - 2007 Q.8 (a)

(i) R : filament S : ovary / ovule 1,1
(ii) Insect pollination 1
- large / brightly coloured petal
- anther / stigma located inside flower
- presence of insect guide any two 1,1

(iii) Pollen grain develops to form a pollen tube 1
Pollen tube carries the male gametes 1
down the style to the ovary / and digests the tissues of the style 1
and releases the male gametes into the ovule 1
(iv) Vegetative propagation 1

CE - 2008 Q.9 (a)

(i) Vegetative propagation 1
(ii) The chromosomes from A fail to pair up with the chromosomes from B during meiotic cell division 1
because they are not homologous chromosomes 1
Therefore, hybrid C fails to produce gametes
(iii) (1) Wind 1
Feathery stigma
Stigma exposed
Anthers exposed } Absence of petals } any two 1, 1

(2) During the experiment, use a plastic bag to wrap the treated flowers except during the following treatments 1
Remove the anthers from the flowers 1
Use a brush to transfer the pollen grains from other flowers to the stigma of the treated flowers 1

CE - 2009 Q.8 (b)

(b) (i) The man: low sperm count / poor sperm mobility / sperms with structural defects / fail to copulate# 1
The woman: blocked oviduct / unsuccessful implantation / no or few ovulation / fail to copulate# 1
(# award mark once)

(ii) It is necessary to stimulate development of ova through hormone injection so that more ova can be collected 1
One ejaculation of the male already contains millions of sperms 1

(iii) (1) Some embryos fail to implant in the uterus 1

(2) Yes
Since the embryos may develop from the fertilization of two different sperms with two ova 1
The two sperms may carry different sex chromosomes 1

AL - 2002 2B

4. (b) • maternal digestion: protease breaks down proteins to amino acids (1) / peptides, in stomach and small intestine (1) — 2
• absorbed into the maternal blood stream at the ileum (1) — 1
• a.a. carried via veins to hearts, then along artery to uterine wall (1) — 1
• a.a. diffuse across the *placenta into foetal blood circulation (1) — 1

AL - 2004 1A

8. (a) (i) • mitochondria close to the tail (1)
• provide energy for motility of the tail of sperm (1) — 2
(ii) (1) • from the ovum (1) / female — 1
(2) Any one (1 mark): — 1
• trace genetic line from female
• parentage identification

(b) • male sperm contains X and Y chromosomes, when 2 nuclei are combined (1), — 2
• the result is either female, when the nuclei of two sperms containing X chromosome are used, or male, when the nucleus of one sperm containing X chromosome and one sperm containing Y chromosome are used (1)

AL - 2006 2B

4. (a)

e.g.	Humans	Flowering plants	
Transfer process	• no external agents required for the transfer of sperms	• in many plants, external agents (1) such as insects or wind (1) are required	1, 1
	• copulation (1) to bring male and female parents together for the transfer	• male and female parts are separated during the transfer (1)	1 + 1
	• throughout the transfer process, sperms re within the human body (1)	• pollen grains are often released to the environment (1) when transferred from anther to stigma	1 + 1 max. 4
Fertilization	• a liquid medium (1) / semen is needed for the motility of the sperms • sperms are propelled up the female reproductive tract by the contraction of the uterus and oviduct (1)	• male gametes are transferred by pollen tube (1) which grow into the ovule (1) containing the female gamete	2 + 2
	• no digestion of tissues during the movement of sperms up the female tract	• tissue of style is digested during the growth of the pollen tube (1)	1
	• active movement of sperms involved	• passive transfer of male gametes (1)	1
	• single fertilization (1) of one sperm with one ovum	• double fertilization (1) with one male gamete fusing with the female gamete and the other male gamete fusing with the endospermic nucleus (1)	1 + 2 max. 8

max. 10

DSE-2012 1B

11.

Differences	*Significance*	
• Pairing of homologous chromosomes along the equatorial plane in first division of meiosis but no such process in mitosis (1)	• Such that the daughter cells formed contain the whole set of chromosome / one member of each homologous pairs (1) after meiosis	
• The pairs of homologous chromosomes segregate into the daughter nuclei during the first meiotic cell division (1)	• Random segregation of homologous chromosomes results in variations between gametes formed in meiosis (1)	(5)
	• Crossing over may occurs, the exchange of genetic materials between non-sister chromatids gives rises to new genetic combinations (1)	
• Mitosis involves one division only but meiosis involves two divisions (1)	• The daughter cells resulted from mitosis are genetically identical to the parent cell (1) which is important for growth of the organisms (1) / asexual reproduction	
	• The daughter cells / gametes formed in resulted from meiosis contain half / haploid the genetic content of the parent cell (1) such that the amount of genetic content can be restored after fertilisation (1)	(5)
D = (3)	**S = max.5**	Max. 8

Communication — **C = max.3**

11 marks

DSE-2014 1B

3. (a) • since each of the separated cells was able to develop into a complete organism, this implies a whole set of genetic material is present in each cell / there was no reduction in the quantity of genetic material during the first division (1) — (1)

[For deliberation in markers' meeting: if there was a reduction in genetic material, the separated cell would not be able to develop into a complete organism (1)]

(b)

Science knowledge is tentative and subject to change.	Spemann's results disproved the general belief, showing that scientific knowledge will change when there is new evidence evolved (1)	(1)
Interpretation of observation is guided by our prior understanding of other theories and concepts.	Scientist observed that cells divides into two and believed that all the materials inside will be divided too without knowing that genetic materials will be duplicated (1) / Spemann found that each of the two separated cells developed into a complete organism and interpret that each cell contain complete set of genetic materials because all genetic materials are required to form a whole organism	(1)

(c) • in mitosis, DNA / chromosomes / genetic material is duplicated right before cell division (1) (1)
• the duplicated chromosomes will line up at the middle part of the cell for division (1) (1)
• each member / half of the duplicated chromosomes will then separate and eventually divide equally into each daughter cell (1) (1)

6 marks

DSE-2014 1B

8. (a) • coloured /large petals (1) and anther within the flower tube (1) (2)

(b) (i) • middle part (1) (1)

(ii) • type Q flower (1)
• because its stigma is located at the middle level of the flower tube (1) which is at the same position where the middle part of the sucking tube will touch upon (2)

(iii) • this ensures that pollination is done between different individuals (1)
• so that the genetic variation of the offspring can be increased (1) (2)

7 marks

DSE – 2015 1B

2. (a) *chromosome / chromatid 1

(b) stage A (1)
Genetic materials are dispersed/ not condensed/ loosely packed at stage A (1) which indicates that the DNA molecules are ready for transcription 2

(c)

	Outcome		*Cause*
	Mitosis	*Meiosis*	
Number of daughter cells	*2*	*4*	Mitosis involves one division while meiosis involves two divisions (1)
DNA content in daughter cells	*2N*	*1N*	Homologous chromosomes (pair up) and separate into each daughter cell in meiosis but not in mitosis (1)

2

DSE – 2016 1B

2.

8. (a) those with the cap removed could regenerate the cap / the stalk and foot alone could regenerate the cap (1)
those with the foot removed could not regenerate the foot / the cap and stalk alone could not regenerate the foot (1) 2

(b) (i) (1) RNA 1
(2) RNA directs the protein synthesis through translation (1)
the protein produced determine the morphology of the cap by acting as enzymes or structural proteins (1) 2

(ii) the final morphological feature of the cap resembles that of Species 2 (1) showing that the trait is determined by the foot of Species 2 but not the stalk from Species 1 (1) and thus the permanent heredity information is stably stored in the foot 2

HKDSE – 2017 1B

3. (a) • cross-pollination (1) (1)

(b) • after landing on the stigma, pollens germinate to form pollen tubes (1)
• which carry the male gametes /male nuclei/pollens containing male gametes /male nuclei (1)
• pollen tubes grow along the style to reach the ovules/ the micropyle in the ovary / towards the ovules in the ovary (1)
• the male gametes/male nuclei will be released to fuse with the female gametes/female nuclei (1) in the ovules (4)

Instructions to markers: (1) candidates should elaborate on the fertilization process with the correct sequence of events, and (2) candidates must correctly mention ovules in the answer in order to score the fourth mark.

(c) • process Y involves combination of genes from two different individuals (1)
• hence, the fertilised eggs / offspring from process Y have greater genetic variations than those from process X (1) for contributing to evolution

Instructions to markers: (1) candidates must mention fertilized eggs/offspring in order to score the second mark.

OR

process Y could give rise to greater genetic variations than process X (1) individuals with variants would be candidates for natural selection which is one of the mechanisms of evolution (1). (2)

7 marks

HKDSE – 2019 1B

3. (a) • anther / ovary / ovule / pollen sac (1) (1)

(b) (i) • crossing over* / crossing-over* / formation of chiasma* (1) (1)

(ii) • exchange of genetic materials between (non-sister chromatids of) the homologous pair of chromosomes (1) (2)
• is an important source of genetic variation / new combination of alleles in chromosomes in sexual reproduction / this produces recombinant chromosomes (1)

(c) (i) • Photomicrograph Y belongs to the first meiotic cell division (1)

- because pairing or separation of homologous chromosomes is shown (1), which is the characteristic feature in first meiotic cell division (2)

(ii)
- first meiotic cell division separates the two sets of homologous chromosomes / produces haploid nuclei / 2N to 1N (1) (not acceptive: reductive division)
- while second meiotic cell division separates the (duplicated) chromosomes / the (sister) chromatids (1) (not acceptable: halve the number of chromosomes, to form haploid gametes, to restore the diploid state of a cell after fertilization) (2)

8 marks