Cell division & cell specialisation

1

1 mark

Meiosis produces four unique haploid daughter cells. At which stage in meiosis are haploid nuclei first formed?

A. Anaphase 2

B. Telophase 1

C. Telophase 2

D. Cytokinesis

Choose your answer

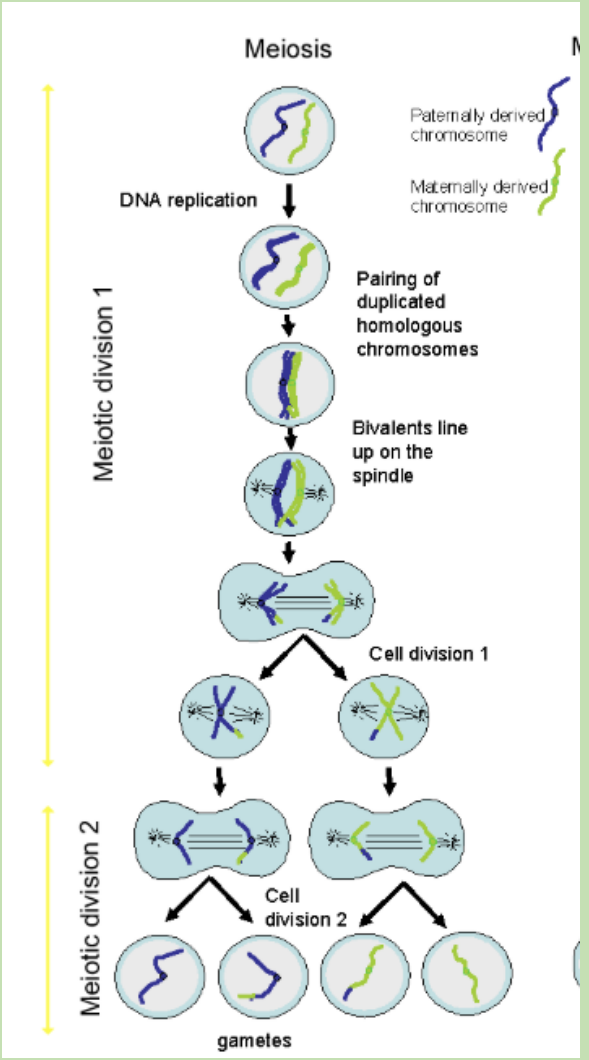
A B C D

The correct answer is B (Telophase 1): At the end of Meiosis I, the cells officially have a haploid set of chromosomes. The nuclear membranes begin to reform around each set of chromosomes in Telophase 1, establishing haploid nuclei for the first time.

A is incorrect because anaphase 2 involves the separation of sister chromatids and the nuclear envelope does not re-form until telophase.

C is incorrect because sister chromatids separate during telophase 2, not homologous pairs, so the chromosome number does not change.

D is incorrect because the nuclear envelopes are re-formed during telophase, before cytokinesis.



2

1 mark

Guard cells are specialised cells in plants which control the opening and closing of stomata on the underside of leaves.

Which of the following is **not** true about guard cells?

A. They differentiate from stem cells

B. They can carry out mitosis

C. Each guard cell contains the complete organism genome

D. They use ATP even when they are not opening and closing the stomata

Choose your answer

A B C D

The correct answer is B. Highly specialised cells such as guard cells cannot divide in mitosis to form new cells, they are produced from stem cells.

A is incorrect because guard cells are produced by the mitosis of stem cells and differentiate to carry out their function.

C is incorrect because, though only a subset of genes are active, each guard cell nucleus contains the entire genome of the organism

D is incorrect because all cells continually use ATP for metabolic processes.

3

1 mark

Mitosis and meiosis are both kinds of nuclear division. Mitosis produces two identical, diploid daughter cells and meiosis produces four unique, haploid daughter cells.

Which process below occurs in meiosis but not in mitosis?

A. Crossing over between non-sister chromatids

B. Centrioles produce spindle fibres

C. Sister chromatids separate and are pulled to either end of the cell

D. New nuclear envelopes form

Choose your answer

A B C D

The correct answer is A because crossing over is one of the processes leading to the formation of genetically different daughter cells during meiosis. Since mitosis form identical daughter cells, crossing over would not occur during this type of nuclear division.

B is incorrect because spindle fibres are produced by the centrioles from either pole of the cell in both mitosis and meiosis

C is incorrect because sister chromatids are separated in both anaphase of mitosis and anaphase 2 of meiosis

D is incorrect because new nuclear envelopes form in telophase of mitosis, and telophase 1 and 2 of meiosis.

4

1 mark

Erythrocytes are specialised cells which contain haemoglobin and have a short lifespan.

Which of the following correctly describes how erythrocytes are formed?

A. Erythrocytes undergo mitosis

B. Pluripotent stem cells in the bone marrow produce erythrocyte precursors

C. Multipotent stem cells in the bone marrow produce erythrocyte precursors

D. Erythrocytes differentiate from other specialised blood cell types

Choose your answer

A B C D

The correct answer is C because adult humans contain only multipotent stem cells which produce a limited range of cells. Erythrocytes differentiate from cells produced by multipotent stem cells in bone marrow.

A is incorrect because erythrocytes contain no nucleus or organelles so they cannot undergo mitosis.

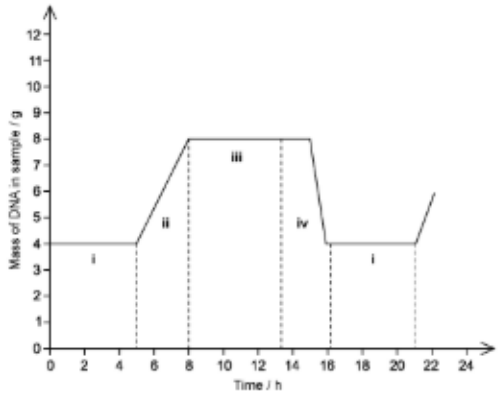
B is incorrect because adult humans do not contain pluripotent stem cells

D is incorrect because specialised cells cannot turn into another kind of cell

5

1 mark

The cell cycle has three stages, interphase, mitosis and cytokinesis. The mass of DNA in the cell throughout the cell cycle can be measured with flow cytometry. Which of the following stages represents the G2 phase of interphase?



A. i

B. ii

C. iii

D. iv

Choose your answer

A B C D

The correct answer is C because G2 occurs after the S phase, during which the DNA is duplicated. So, there is double the normal mass of DNA in the cell during G2.

A is incorrect because there is a lower mass of DNA, which indicates that this is the G1 phase

B is incorrect because the DNA mass is increasing, which indicates that this is the S phase when DNA replication occurs

D is incorrect because the DNA mass is decreasing, due to the division that occurs during cytokinesis.

The cell cycle is divided into distinct phases during which tightly-regulated cellular processes occur.

Figure 1.1 shows the different phases of the cell cycle.

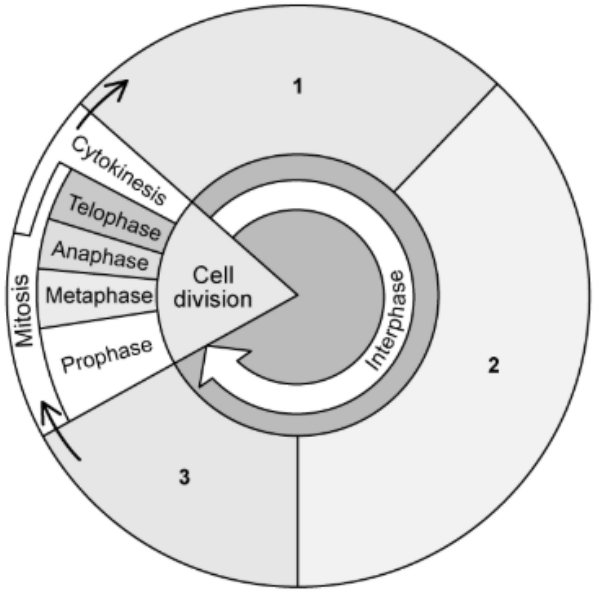


Figure 1.1

During interphase, the cell grows and carries out cellular functions.

(i) Identify phase 1, 2 and 3 of interphase in Figure 1.1

[3]

(ii) State the cellular process that occurs during phase 2 of interphase. [1]

(iii) Name the molecules that signal the cell to move between stages of the cell cycle.

[1]

(i) Three stages of interphase would be:

- 1 = G_1; [1 mark]
- 2 = S phase; [1 mark]
- 3 = G_2; [1 mark]

(ii) The process that occurs during phase 2 of interphase is called:

- DNA replication; [1 mark]

(iii) The molecules that signal the cell to move between stages of the cell cycle would be.

- Cyclins; [1 mark]

[Total: 5 marks]

1

1 mark

Which of the following statements, **A** to **D**, is **not** true of human erythrocytes?

A. They are produced from stem cells.

B. They are produced in bone marrow.

C. They are specialised cells.

D. They undergo mitosis.

Choose your answer

A B C D

The correct answer is D, they undergo mitosis, because…

Erythrocytes do not have a nucleus and so cannot carry out mitosis or any cell division.

Erythrocytes carry out the functions of **A**, **B** and **C**.

2

1 mark

Which of the following, **A** to **D**, is **not** true about adult stem cells?

A. They are found in bone marrow.

B. They are not specialised.

C. They are totipotent.

D. They can be used as a renewing source of undifferentiated cells.

Choose your answer

A B C D

The correct answer is C because...

Totipotency refers to embryonic stem cells, in that they can differentiate into any type of cell.

A, B and D are all true of adult stem cells and so are incorrect answers.

3

1 mark

Rheumatoid arthritis is a long-term condition that causes pain, swelling and stiffness in the joints.

Which of the following, **A** to **D**, explains why stem cells are a potential source of treatment for rheumatoid arthritis?

A. Stem cells can be harvested from the umbilical cords of newborn babies.

B. Stem cells are cheaper than other drug-based therapies.

C. Stem cells allow regeneration of a variety of tissue types.

D. Stem cells can be obtained from embryos without any ethical concerns.

Choose your answer

A B C D

The correct answer is C.

This is because this statement gives a valid reason that using stem cells to treat rheumatoid arthritis may be successful.

A is a correct statement about stem cells, however, is an incorrect answer as it does not give a valid reason for using stem cells for treating arthritis.

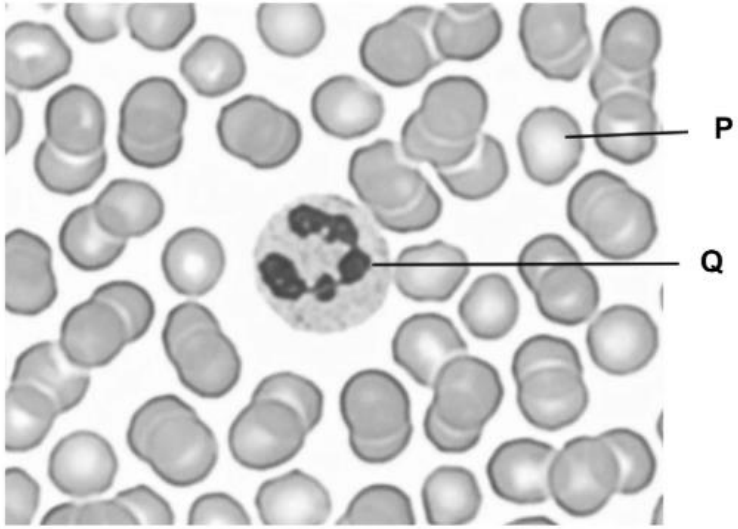
B is incorrect as the cost of stem cells is not necessarily cheaper than other drug based therapies, although it may be cheaper in some scenarios.

D is incorrect as it does not provide a valid reason for using stem cells and is also incorrect as embryonic stem cells have many ethical issues associated.

4

1 mark

The image below shows a micrograph of two different types of blood cell.



Which of the following rows, **A** to **D**, shows the correct cell names from the image above?

	P	Q
A	neutrophil	erythrocyte
B	erythrocyte	epithelial cell
C	erythrocyte	neutrophil
D	epithelial cell	erythrocyte

Choose your answer

A B C D

The correct answer is C.

The erythrocyte (P) is shown to lack a nucleus and also appears to have a slight difference in density of cellular material in the centre, this is due to the biconcave shape of the cell. The neutrophil can be recognised by the characteristic lobed nucleus which allows flexibility required during phagocytosis.

A is incorrect as the labels are in the wrong order.

B and **D** both refer to epithelial cells, this means they are incorrect on that basis alone as an epithelial cell is not found in the blood. Epithelial cells cover surfaces throughout the body on the inside and outside e.g. skin or intestinal wall.

1a

4 marks

Mitosis and meiosis are important in the life cycles of organisms.

Hydra is a small animal that lives in fresh water. When environmental conditions are favourable, *Hydra* reproduces asexually. Large numbers of offspring can be produced in this way.

Asexual reproduction in Hydra is shown in Fig. 19.1.

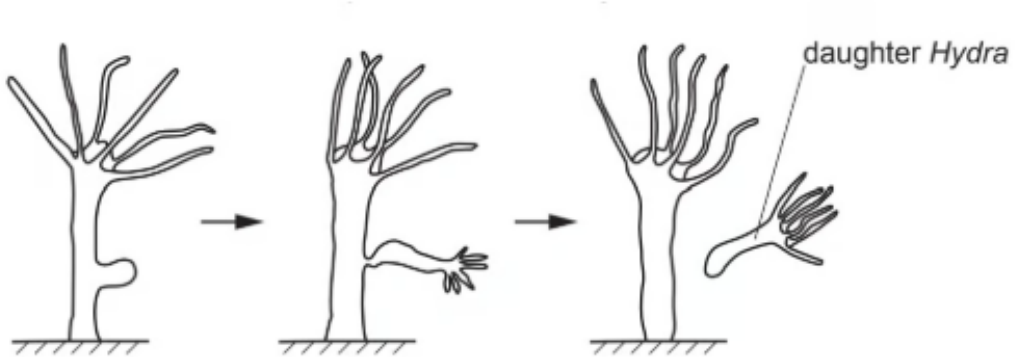


Fig. 19.1

(i) Asexual reproduction involves mitosis.

Name the stages of mitosis in the correct order.

[2]

(ii) Suggest why *Hydra* reproduces asexually when conditions are favourable.

[2]

(i) The stages of mitosis in the correct order are...

- prophase **then** metaphase **then** anaphase **then** telophase; [2 marks]

Allow *maximum* [1 mark] *if interphase or cytokinesis are mentioned.*

Allow [1 mark] *if the phases are named correctly but not in correct order.*

(ii) *Hydra* reproduces asexually when conditions are favourable because...

Any two of the following:

- To produce genetically identical offspring; [1 mark]
- Offspring are produced rapidly / in large numbers **OR** finding mates requires time/energy **OR** population can increase rapidly; [1 mark]
- (All) offspring will find conditions favourable / have the same adaptations; [1 mark]

Ignore *reference to clones for marking point 1.*

[Total: 4 marks]

1b

7 marks

When conditions are not favourable, *Hydra* reproduces sexually. This often happens in the winter.

Cells in the body wall produce sperms and eggs by meiosis.

Large numbers of sperms are released into the water. These sperms can fertilise eggs from different individuals. Each egg forms a tough outer coat, and can lie dormant at the bottom of the water until conditions improve.

(i) Explain how sexual reproduction in *Hydra* leads to genetic variation in the offspring.

[6]

(ii) Suggest why sexual reproduction in *Hydra* usually occurs in the winter.

[1]

(i) Sexual reproduction in *Hydra* leads to genetic variation in the offspring because...

This question assesses the quality of your written communication and should be assessed using the following levelled criteria:

	Science content	Communication
Level 3 [5–6 marks]	Explains in detail how sexual reproduction leads to genetic variation with reference to more than one stage of meiosis and with reference to *Hydra*.	*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated*
Level 2 [3–4 marks]	Explains in some detail how sexual reproduction leads to genetic variation with reference to more than one stage of meiosis **OR** with reference to *Hydra* and one stage of meiosis.	*There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.*
Level 1 [1–2 marks]	Mentions more than one reason why sexual reproduction leads to genetic variation.	*The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.*

Indicative content:

- Genetic variation is the variety of alleles
- Offspring have alleles from more than one parent
- Random fertilisation
- Meiosis produces genetically unique gametes:
  - Crossing over in prophase 1
  - Alleles swapped between non-sister chromatids
  - Base sequence of chromosomes altered
  - Independent assortment / random segregation
  - In metaphase 1
  - Also relevant in metaphase
- The sperm from one *Hydra* can fertilise an egg from any other individual *Hydra*
- The two *Hydra* can have different alleles
- Sperm carried in water might travel large distances to unrelated *Hydra*

This question should be marked with a 'best fit' approach where the level is determined by the scientific content and the mark within the level is determined by the quality of the written communication.

Make sure you have read all the information in the question carefully. It would be easy here to mistake *Hydra* for plants due to their appearance but it clearly states in the question that they are animals. This mistake would drastically change your answer (and therefore marks!) so be sure to read and reread questions to ensure you have all the correct information.

(ii) Sexual reproduction of *Hydra* occurs in winter because...

Any one of the following:

- (Some offspring) might survive unfavourable conditions; [1 mark]
- (Some) offspring have useful alleles; [1 mark]
- (Named) unfavourable conditions mean (all) offspring might die (if asexual); [1 mark]

Ignore *eggs can lie dormant for marking point 1, as this is stated in the question stem.*
Ignore *that they will be less susceptible to unfavourable conditions for marking point 1.*

[Total: 7 marks]

1c

4 marks

Mosses are small plants that live in damp conditions.

The life cycle of many mosses involves two stages: a gametophyte and a sporophyte.

The gametophyte contains haploid cells and produces sperms and eggs.

The sporophyte contains diploid cells and produces spores which can be spread easily through the air.

The spores germinate and grow into a gametophyte.

Fig. 19.2 shows the life cycle of the moss Funaria.

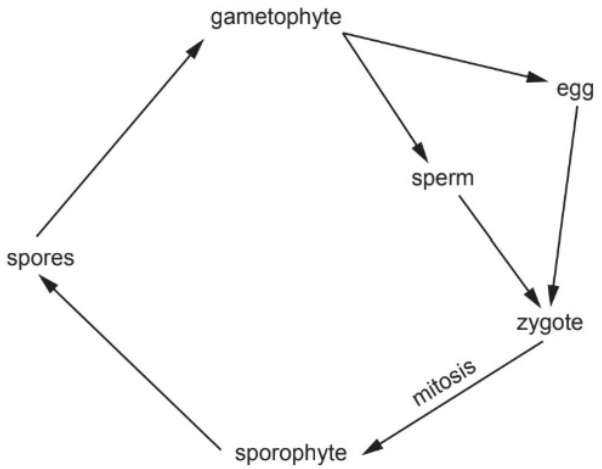


Fig. 19.2

(i) The zygote grows into the sporophyte by mitosis.

The haploid gametophyte of one species of Funaria contains 28 chromosomes.

A single DNA molecule contains two strands.

Calculate the number of strands of DNA present in the nucleus of the zygote immediately before mitosis.

[1]

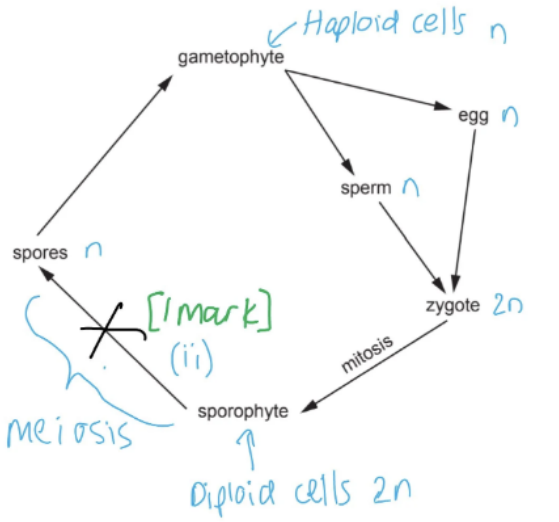
(ii) Mark an **X** on **Fig. 19.2** at the point at which meiosis occurs.

[1]

(i) The number of strands of DNA present in the nucleus of the zygote immediately before mitosis is...

- 224; [1 mark]

You are told in the question that the sporophyte is diploid and the gametophyte is haploid; so meiosis must occur somewhere between these two stages. You are also told that the spores grow into a gametophyte and we know that growth occurs by mitosis so this means that the spores must have the same chromosome number as the gametophyte and that meiosis must be between sporophyte and spore in order to half the chromosome number.



(i) Haploid number of chromosomes = 28

∴ Diploid number = 28 × 2 = 56
↳ After DNA replication = 56 × 2 = 112
↳ Two strands per molecule = 112 × 2 =
[1 mark] 224

(ii) An X on Fig. 19.2 at the point at which meiosis occurs is...

- a cross drawn anywhere between sporophyte and spores; [1 mark]

5

1 mark

Which of the following statements, **A** to **D**, correctly explains why meristems can differentiate into xylem vessels in plant stems?

A. Meristems are living and unspecialised.

B. Meristems are living and specialised.

C. Xylem vessels are dead and specialised.

D. Xylem vessels are dead and unspecialised.

Choose your answer

A B C D

The correct answer is A.

The meristem tissue is the stem cell tissue found in plants. From the meristem, xylem and phloem can develop. The meristem is unspecialised, but cells become specialised as xylem or phloem cells during differentiation.

B is incorrect because the meristem must be unspecialised in order to develop into the xylem and the phloem later.

C is incorrect. Although the statement correctly refers to features of the xylem, it does not explain why the meristem differentiates into xylem and therefore doesn't answer the question.

D is incorrect as xylem vessels are made from dead cells but it is a specialised structure.

6

1 mark

Meiosis is an important feature of sexual reproduction.

Which of the following processes occurs during meiosis and contributes to genetic variation in the offspring?

1 crossing over
2 gene mutation
3 random fertilisation

A. 1, 2 and 3

B. only 1 and 2

C. only 2 and 3

D. only 1

Choose your answer

A B C D

The correct answer is D.

The reason for this is that of all the processes listed, it is only crossing over that occurs during meiosis and contributes to genetic variation.

The other answers are incorrect because even though both gene mutation and random fertilisation contribute to genetic variation, none of them occurs during meiosis.

7

1 mark

Corals are a group of animals that usually live on the sea bed close to the surface of the water.

Many corals can reproduce both sexually and asexually.

Which of the following statements about asexually-produced coral offspring is **not** true?

A. All offspring produced from an individual organism will be genetically identical.

B. If a change in the environment harms one of the offspring produced from an individual organism it will probably harm them all.

C. Meiosis occurred in order to produce the offspring.

D. The offspring will tend to thrive if conditions are similar to those present when the parent organism reproduced.

Choose your answer

A B C D

The correct answer is C.

The reason for this is that meiosis is involved with the production of gametes which are necessary for sexual reproduction. The asexually-produced coral offspring would have formed due to **mitosis**.

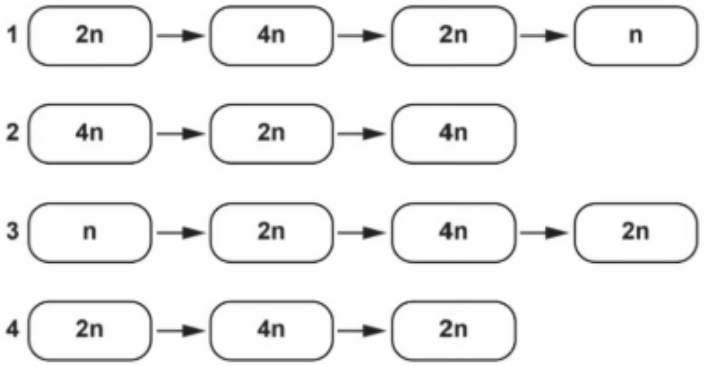
The other answers are incorrect because they are all true statements about asexually-produced coral offspring.

8

1 mark

During cell division, the chromosome number in the cells changes.

The following sequences describe the chromosome number in cells before, during and after different types of cell division.



Which of the options, **A** to **D**, correctly describes the stages of mitosis and meiosis in human cells?

A. 1 is mitosis, 2 is meiosis

B. 2 is mitosis, 3 is meiosis

C. 3 is mitosis, 4 is meiosis

D. 4 is mitosis, 1 is meiosis

Choose your answer

A B C D

The correct answer is D.

The reason for this is that both mitosis and meiosis begins with a diploid cell(2n). During the S-phase of Interphase, DNA replication will occur which leads to a doubling of the amount of DNA in the cell(4n). During mitosis nuclear division occurs once to form two identical diploid cells (2n), while in meiosis nuclear division occurs twice to produce four non-identical haploid cells(n).

The other answers are incorrect because sequence 2 is not possible since there is no type of cell division where the chromosome number will halve and then double again. Sequence 3 is also not possible because the chromosome number will not double twice (n to 2n and then to 4n) and then halve.

2a

3 marks

The cell pictured in Figure. 2.1 is undergoing the prophase stage of mitosis. Identify structures **A**, **B** and **C** and describe how they behave during prophase.

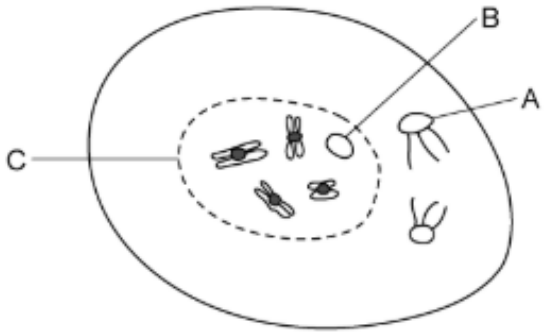


Figure. 2.1

Label	Name of structure	Behaviour during prophase
A		
B		
C		

[1 mark] for each fully correct row

Label	Name of structure	Behaviour during prophase	Marks
A	centrosome	Moves to opposite poles **AND** anchors/attaches the spindle;	[1 mark]
B	nucleolus	Disappears / disintegrates;	[1 mark]
C	nuclear envelope / membrane	Breaks down into small vesicles;	[1 mark]

[Total: 3 marks]

9

1 mark

The haploid chromosome number in the koala, *Phascolarctos cinereus*, is 8.

Independent assortment of chromosomes in meiosis contributes to genetic variation in the gametes of the koala.

How many genetically different versions of koala gamete would it be possible for one individual to produce if independent assortment were the only source of genetic variation?

A. 64

B. 128

C. 256

D. 512

Choose your answer

A B C D

The correct answer is C.

Formula for working out possible chromosome combinations:

2^n — nr. of chromosomes in a haploid cell

2^8

$= 256$

10

1 mark

Which statement explains the significance of mitosis in the development of whole organisms?

A. Mitosis can be controlled at certain points in development, which will change body plans.

B. Sex cells are produced by mitosis, which allows new organisms to be produced.

C. Mitosis limits the total number of cells in an organism, which will change its shape.

D. Budding in yeast is an example of mitosis, producing new multicellular organisms.

Choose your answer

A B C D

The correct answer is A.

The reason for this is that mitosis can be controlled as part of development by controlling which genes are expressed in order to help form the basic plan of the body.

The other answers are incorrect because (B) sex cells are produced by meiosis, not mitosis. (C) mitosis does not limit the number of cells in the body. (D) budding is an example of mitosis in yeast, but this produces unicellular organisms, not multicellular.

4a

3 marks

Distinguish between totipotent, multipotent and pluripotent cells.

The differences between totipotent, multipotent and pluripotent cells are as follows:

Any three of the following:

- Totipotent cells can differentiate into any type of cell in the body **OR** totipotent cells are found in the zygote; [1 mark]
- Multipotent cells can differentiate into a limited number of cell types **OR** multipotent cells are found in the umbilical cord/some adult tissues/named example; [1 mark]
- Pluripotent cells can differentiate into almost any/most cell type (but not all) **OR** pluripotent cells are found in the embryo; [1 mark]

[Total: 3 marks]

Stem cells have a variety of different capabilities, depending on where they are harvested from and at what stage of development. Stem cells are a fundamental part of body **growth** and **regeneration**, however, only those found in the very early stages **after fertilisation** can provide a **significant range** of potential cell types. Stem cells found later in development are already predisposed to becoming a **limited range** of cell types.

4b

5 marks

Pluripotent stem cells extracted from the early embryo can be used to treat a variety of diseases including muscular dystrophy, osteoporosis and macular degeneration. However, in 2006, scientists in Japan found that adult stem cells could become induced pluripotent stem cells. Some believe that the use of induced pluripotent stem cells is a more appropriate method for treatment of patients than pluripotent stem cells.

Evaluate the use of pluripotent and induced pluripotent stem cells in treatment of life changing diseases such as those mentioned above.

Pluripotent and induced pluripotent stem cells can…

Any one of the following:

- Differentiate into nearly any other cell type **OR** can produce many other cell types; [1 mark]
- Can self-renew/regenerate **OR** potentially divide indefinitely **OR** provide a limitless supply; [1 mark]
- Could be used to treat potentially life changing conditions **OR** prevent fatal consequences; [1 mark]

Pluripotent stem cells …

Any two of the following:

- (Using embryonic stem cells) results in the destruction of embryos; [1 mark]
- Each embryo has the potential to become a human life **OR** develop into a fetus if implanted; [1 mark]
- There may also be religious/ethical objections; [1 mark]
- Can be obtained from discarded IVF embryos; [1 mark]

Induced pluripotent stem cells…

Any two of the following:

- Produced from a unipotent cell; [1 mark]
- Can originate from the patient **so** would be genetically identical (to the patient's body cells); [1 mark]
- (Using the patient's own body cells) means there is no risk of rejection **OR** no immune response **OR** no need for immunosuppressants; [1 mark]
- The patient can provide consent for taking stem cell samples; [1 mark]
- Respond in a very similar way to pluripotent cells **but** are not identical to embryonic stem cells; [1 mark]

[Total: 5 marks]

There are many discussion points involved in this topic, but try to consider the **scientific** as well as the **ethical** arguments. Stem cells which originate from embryos come with many ethical negatives, many of which are overcome in the use of induced pluripotent cells. Adults can give **consent** to stem cell samples being extracted, whereas the embryo cannot. However, some believe that it is wasteful not to make use of **discarded embryos** from fertility clinics if it provides the opportunity to help a patient who is suffering from a treatable disease.

6d

4 marks

A diploid organism contains 38 chromosomes.

Calculate the possible number of different combinations of chromosomes following meiosis **and** explain why this value may not be the actual number.

The possible number of different combinations of chromosomes following meiosis is:

- 2^n
- 2^{19}
- 524 288; [1 mark]

This value may not be the actual number because:

- It only takes into account the effects of independent segregation; [1 mark]
- It doesn't take into account crossing over / crossing over can occur, when there is an exchange of alleles between homologous chromosomes; [1 mark]
- Resulting in new / different combinations of alleles; [1 mark]

[Total: 4 marks]

The number of different combinations of chromosomes following meiosis can be calculated by using the formula 2n where n is the number of homologous chromosome pairs in a diploid organism. In this case, if there are 38 chromosomes then there must be 19 pairs.

1

1 mark

The cells in the root tip of a Hyacinth plant were viewed under a microscope. The total number of cells in the field of view was 277.

The number of cells at each different stage of the cell cycle are shown below:

Stage of cell cycle	Number of cells
Interphase	198
Prophase	36
Metaphase	23
Anaphase	8
Telophase	12

A complete cell cycle in the Hyacinth root tip cells takes 20 hours. Which of the following answers shows the time taken for metaphase to occur?

A. 9 minutes

B. 12 minutes

C. 36 minutes

D. 100 minutes

Choose your answer

A B C D

The correct answer is D because:

- Length of time in stage = $\frac{\text{observed number of cells in stage}}{\text{Total number of cells observed}}$ X total length of cycle

$= \frac{23}{277} \times 20$

= 1.66 hours

= 100 minutes

2

1 mark

Which of the following statements explains how meristems differentiate into xylem and phloem tissue?

A. Stem cells at the inner edge of the cambium differentiate into phloem cells

B. Cambium cells are pluripotent and cell differentiation is stimulated by hormones.

C. Cambium cells that differentiate to form xylem lose their cytoplasm and deposit cellulose into their cell walls

D. Cambium cells that differentiate to form phloem lose their end cell walls.

Choose your answer

A B C D

The correct answer is B because:

- The cell differentiation is stimulated by hormones and the balance of different hormones can determine whether xylem or phloem tissue is produced. The cambium cells are pluripotent as specialisation of these cells is limited to to either xylem or phloem

A is incorrect as stem cells at the inner edge of the cambium differentiate into **xylem** cells and stem cells at the **outer** edge of the cambium differentiate into phloem cells.

C is incorrect as cambium cells that differentiate to form xylem do lose their cytoplasm but deposit **lignin** in their cell walls.

D is incorrect as cambium cells that differentiate to form phloem develop **sieve plates** at the ends of cells whereas those that differentiate to form **xylem** lose their end cell walls.

3

1 mark

Which of the statements below explain why prokaryotic cells do not undergo mitosis?

1	Prophase involves the breaking down of the nuclear envelope.
2	DNA in prokaryotic cells is not replicated.
3	Prokaryotes do not have a nucleus or multiple chromosomes.

A. Statements 1, 2 and 3

B. Statements 1 and 2 only

C. Statements 2 and 3 only.

D. Statement 3 only.

Choose your answer

A B C D

The correct answer is D because:

- Prokaryotes do not undergo mitosis as they do not have a nucleus or multiple chromosomes so the process of cell division is simplified and occurs via binary fission.

A is incorrect as it includes statement 1 which is incorrect as prokaryotic cells do not have nuclear envelopes. It also includes statement 2 which is incorrect as cell division in both prokaryotic and eukaryotic cells begins with DNA replication.

B is incorrect as it includes incorrect statements 1 and 2.

C is incorrect as it includes incorrect statement 2.

4

1 mark

Many plants are able to asexually produce natural clones, a process that is rare in animals.

Which of the statements below does **not** explain why plants are more able to form natural reproductive clones?

A. Most animal cells are not totipotent.

B. Plants have meristematic tissue

C. Most plant cells are pluripotent.

D. Plant cells can de-differentiate and then differentiate again.

Choose your answer

A B C D

The correct answer is C because:

- **Most plant cells are totipotent and therefore retain their ability to differentiate.**

A is incorrect as most animal cells are not totipotent, meaning they can only differentiate into the same types of cell.

B is incorrect as plants have meristematic tissue found at the growing regions of plants that is fully undifferentiated.

D is incorrect as plant cells are able to de-differentiate and then differentiate into a different cell type.

5

1 mark

A potential future treatment for diabetes is treatment with stem cells to replace faulty pancreatic β cells. A consideration in this is whether stem cells transplanted into the body may lead to the development of cancer.

Which of the statements below does not explain why this is a possibility.

A. An immune response to the transplant may lead to cancerous growth.

B. Formation of tumours may occur as a result of unlimited cell division.

C. Stem cells survive for longer than differentiated cells.

D. Mutation of genes in the cells may occur.

Choose your answer

A B C D

The correct answer is A because:

- Although the recipient of the stem cells may have an immune response to the transplant, it would not lead to cancerous growth.

B is incorrect unlimited and uncontrolled cell division in transplanted stem cells may lead to the formation of cancerous tumours.

C is incorrect as stem cells survive for longer than differentiated cells, increasing the chance that they might accumulate genetic mutations which may lead to cancer.

D is incorrect as mutation of genes in stem cells may occur, leading to cancerous tumours forming.