



Biomedical Admissions Test (BMAT)

Section 2: Biology

Questions by Topic

B3 - Cell Division and Sex Determination

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B3: Cell Division and Sex Determination - Questions by Topic

(Mark Scheme and explanations at the end)

1 Which of the following statements about mitosis is false?

- A It is involved in growth and repair.
- B One of the stages is interphase.
- C Mitosis produces four identical daughter cells.
- D There is one, singular round of division.
- E The cells produced are diploid cells.

2 Here are three statements about asexual reproduction.

- 1 This requires only one parent.
- 2 Offspring are genetically different to their parents.
- 3 Two examples include runners and binary fission.

Which of the following statements are true?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1 only
- E 2 only
- F 3 only
- G All of the statements

3 Which of the following statements about reproduction is true?

- A Asexual and sexual reproduction require one parent.
- B Offspring from reproduction have genetic material from each parent.
- C Sexual reproduction requires meiosis to have occurred.
- D Asexual reproduction requires meiosis.
- E Reproduction always causes genetic variation.





4 Which of the following statements about mitosis and meiosis are true?

- 1 Asexual reproduction is a form of mitosis.
- 2 Four rounds of mitosis produce the same number of cells as two occurrences of meiosis.
- 3 Meiosis only occurs in sexual organs.
- 4 Mitosis and meiosis both have interphase.

- A 1 only
B 2 only
C 3 only
D 4 only
E 1, 2 and 3 only
F 1, 3 and 4 only
G All of the above
H None of the above

5 The following diagram shows a Punnett square of sexual reproduction.=

	X	X
X	XX	XX
Y	XY	XY

Which of the following statements is correct?

- A In a litter of 4 pups, two will always be male and two will be female.
B An individual with XX will be male.
C All sperm provide a Y chromosome.
D A gene on the Y chromosome codes for the production of testes.
E None of the above.





6 The following statements relate to meiosis.

- 1** Meiosis is a process of cell division that results in 2 genetically unique daughter cells.
- 2** The daughter cells of meiosis each have the same number of chromosomes.
- 3** Gametes, produced by meiosis, are diploid - they each have 46 chromosomes.
- 4** The daughter cells of meiosis will have different combinations of parent cells' DNA.

Which of these statements are correct?

- A** 1, 2 and 3
- B** 2, 3 and 4
- C** 1, 3 and 4
- D** 2 and 3
- E** 3 and 4
- F** 1 and 2
- G** 2 and 4





7 The following statements relate to specialised cells, such as red blood cells, sperm and egg cells.

- 1 Sperm cells contain large food reserves to provide them with enough energy stores to swim to the egg cell.
- 2 In order to prevent polyploidy (an organism containing more than 2 sets of chromosomes), the sperm changes the structure of the egg cell as soon as it makes contact with the egg cell's surface.
- 3 Sperm cells are much larger than egg cells.
- 4 Mature red blood cells lack both a nucleus and mitochondria.
- 5 Red blood cells have no nucleus, but they do contain mitochondria to provide energy for their cellular processes.

Which of these statements are correct?

- A 1, 2, 3 and 4
- B 1, 2, 3 and 5
- C 1, 2 and 4
- D 1, 3 and 4
- E 1, 2 and 5
- F 2 and 4
- G 1 and 4
- H 2 and 5





8 The following are all statements about mitosis.

- 1 The daughter cells produced through mitosis are genetically identical to the parent cell.
- 2 Mitosis enables repair and replacement of cells that are dead, it is essential for asexual reproduction and growth.
- 3 If not destroyed, cells with defective DNA can continue to replicate uncontrollably, which could lead to cancer.
- 4 Mitosis produces 2 daughter cells that are haploid.
- 5 A cell undergoing mitosis splits into 2 daughter cells through a process called cytokinesis.

Which of these statements are correct?

- A 1, 2, 3 and 4
- B 1, 2, 3 and 5
- C 1, 2 and 4
- D 1, 4 and 5
- E 2, 4 and 5
- F 2 and 4
- G 1 and 4
- H 2 and 5





9 The following are all correct statements about meiosis.

- 1 At the end of meiosis 4 daughter cells are produced.
- 2 Meiosis occurs in most cells in the human body.
- 3 There are two sets of chromosomes in the parent cell, whereas the daughter cells produced through meiosis are haploid, and have only one set of chromosomes.
- 4 The daughter cells produced through meiosis are not genetically identical to each other but are genetically identical to the parent cells.
- 5 Two divisions take place during meiosis.

Which of these statements are correct?

- A 1, 2, 3 and 4
- B 1, 2, 3 and 5
- C 1, 2 and 4
- D 1, 3 and 5
- E 2, 4 and 5
- F 2 and 4
- G 1 and 3
- H 3 and 5



Answers and Explanations

1 **C is the answer.** Mitosis is one division to form two identical daughter cells.

- A** is true – mitosis is also involved in asexual reproduction.
- B** is correct – interphase is the period in which the chromosome number doubles.
- D** is true – as above, mitosis has a single division to form the two daughter cells.
- E** is correct – mitosis forms two diploid daughter cells whereas meiosis forms four unique haploid daughter cells.

2 **B is the answer.** Statements 1 and 3 are correct.

Statement 1 is true. This is because asexual reproduction requires one parent and no fusion of gametes.

Statement 2 is false. Offspring from asexual reproduction are clones – exact replicas of their parent.

Statement 3 is true. Strawberries reproduce asexually using runners and bacteria reproduce using binary fission.

3 **C is the answer.** This is true because sexual reproduction requires gametes which are produced by meiosis.

- A** is false – sexual reproduction requires two parents.
- B** is false – asexual reproduction has only one parent.
- D** is false – asexual reproduction doesn't require gametes – the products of meiosis.
- E** is false – asexual reproduction produces genetically identical clones.



4 **G is the answer.** All four of the statements are true.

Statement 1 is correct – asexual reproduction is the production of clones using asexual reproduction.

Statement 2 is correct – mitosis produces 2 daughter cells – so four rounds would form 8 cells. Meiosis produces 4 daughter cells – 2 occurrences would form cells too.

Statement 3 is correct – meiosis produces gametes in reproductive organs.

Statement 4 is correct – both meiosis and mitosis have a period of interphase in which the chromosomes replicate themselves before dividing.

5 **D is the answer.** This is correct because the Y chromosome provides the gene for a protein which results in testes production.

A is incorrect – it is predicted that there would be 2 of each sex but as fertilisation is a random process it could be any combination of offspring.

B is incorrect – XX individuals are female. A male is XY.

C is incorrect – sperm can provide either an X or a Y whilst eggs always provide an X chromosome.

6 **G is the answer**

1 is incorrect - **meiosis** produces **4 genetically unique daughter cells** (mitosis produces 2 genetically identical daughter cells).

2 is correct - daughter cells of meiosis do have the same number of chromosomes. Note that the function of meiosis is to halve the number of chromosomes to form a haploid cell. Then, **two haploid gametes can be paired at fertilisation to form a diploid cell**.

3 is incorrect, because the **products of meiosis are haploid** (they each have a single set of 23 chromosomes).

4 is correct, because meiosis forms two haploid (half) cells with only 23 chromosomes, rather than 46, by dividing DNA between two daughter cells. Knowing this, all four cells simply can't contain the same DNA as each cell is missing half of the chromosomes! Furthermore, meiosis recombines parent DNA in a way such that all 4 daughter cells will have a different combination of DNA from each other and from the cells they were made from.

Since 2 and 4 are the only true statements, **G** must be the correct answer.





Exam Tip - When thinking of mitosis and meiosis, you need to remember certain key differences between the two. Here's a brief summary of what to remember:

- **Mitosis** produces **two daughter cells** (you can remember this because mitosis contains a 't' for **two**); these daughter cells will be **genetically identical**. In addition, mitosis occurs **everywhere in the body** where more cells are needed, for example in growth or repair.
- **Meiosis** produces **four daughter cells**, which are **genetically different**, and meiosis occurs in the reproductive organs to produce **gametes**.

7 **F is the answer** - Statements **2** and **4** are correct.

- 1 is incorrect - **sperm cells have many mitochondria** to provide the energy needed to swim to the egg cell. It is **egg cells** which in fact **contain large food reserves**, but the purpose of these is to feed the embryo.
- 2 is correct - this is an important mechanism which allows only one sperm to fertilise an egg, thus ensuring offspring have only 46 chromosomes.
- 3 is incorrect - **egg cells are much larger than sperm cells**.
- 4 is correct - all **red blood cells lack a nucleus**, and mature red blood cells also **contain no mitochondria**.
- 5 is therefore incorrect.

Thus, the answer has to be **F**, as **2** and **4** are the only correct options.





8 The answer is B

- 1 is correct - this is because the DNA is replicated before the cells divide during mitosis, the replication takes place during **interphase**. This means the DNA present in the daughter cells is **genetically identical to the parent cell**.
- 2 is correct - mitosis has several roles in the human body. Mitosis produces cells that are genetically identical, therefore this process is essential in **growth, repair and asexual reproduction**. Cells such as plant cells will use the process of mitosis to reproduce.
- 3 is correct - during the process of mitosis when DNA is replicated the cell cycle stops in order to **check if the DNA has been replicated correctly** and no mistakes have been made. If a mistake has been detected then the cell is destroyed. However if the mistake in copying the DNA remains and cannot be corrected the cell continues to replicate, thus there will be a group of cells that are mutated. This could eventually lead to cancer.
- 4 is incorrect - it is correct that the process of mitosis produces two daughter cells, however as stated before DNA gets replicated before the cells divide. Therefore each daughter cell produced is **diploid**, as they contain the same number of chromosomes as the parent cell, whereas option 4 says the cells are haploid.
- 5 is correct - **cytokinesis** is the process by which the cell splits into two daughter cells. This occurs after the nucleus has broken down and replicated.

Since 1, 2, 3 and 5 are the only correct statements, **B** must be the correct answer.





9 The answer is D

- 1 is correct - as meiosis involves **two divisions**, the first division results in 2 daughter cells and then the second division results in 4 daughter cells.
- 2 is incorrect - mitosis is the process that occurs in most cells in the human body, however the process of meiosis occurs in **human reproductive organs - testes and the ovaries**. Meiosis is the process that is essential for **sexual reproduction**. The daughter cells produced are called gametes which contain one copy of each chromosome.
- 3 is correct - as during the first step of meiosis the DNA is replicated, the cells then divide to produce 2 daughter cells. The next stage of division takes place to produce 4 daughter cells. As there are **two stages of division** and only **one stage of replication**, this results in the 4 daughter cells having one copy of each chromosome, therefore are haploid. This is essential for sexual reproduction. Sperm that are produced through meiosis in the testes carry half the genetic information and ova produced through meiosis in the ovaries carry half the genetic information, this ensures the right number of chromosomes are present after fertilisation.
- 4 is incorrect - as the daughter cells produced during meiosis are **genetically different** from the parent cells as well as from each other.
- 5 is correct - **two divisions** take place during **meiosis**, whereas one division takes place during mitosis.

Since 1, 3 and 5 are the only correct statements, **D** must be the correct answer.

