Cell division, cell diversity and cellular organisation – 2021/20 GCE Biology A Component 02

1. Nov/2021/Paper_H420/02/No.3

Which of the following processes is important in determining the overall body plan of an organism?

A endocytosis

B exocytosis

C meiosis

D mitosis

Your answer ☐ **[1]**

2. Nov/2020/Paper_H420/02/No.19

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

(a) *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.

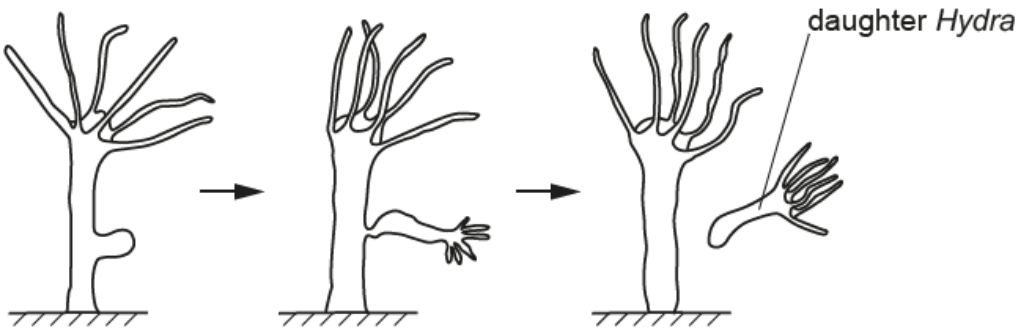

Fig. 19.1

(i) Asexual reproduction involves mitosis.

Name the stages of mitosis in the correct order.

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..... **[2]**

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

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..... **[2]**

(b) 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.

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Additional answer space if required.

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

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(c) 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*.

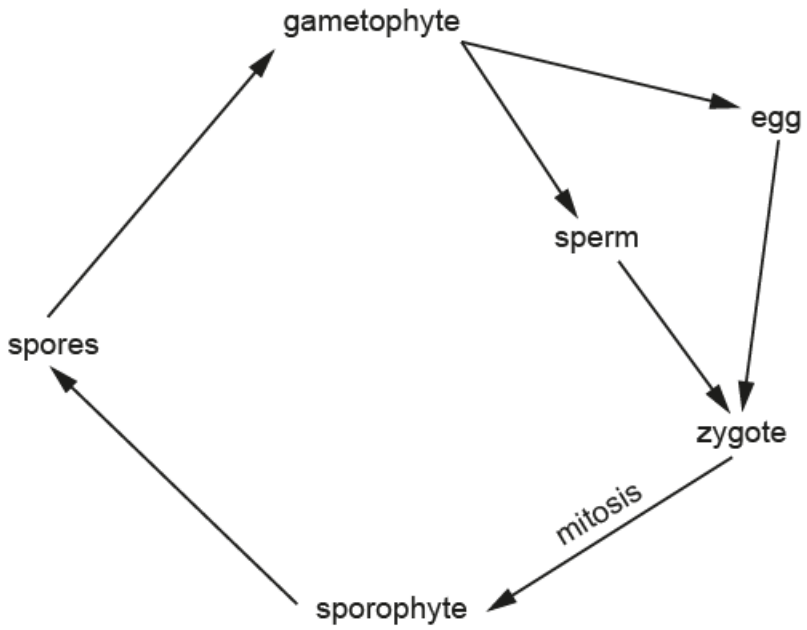

Fig. 19.2

(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.

number of strands = ... **[1]**

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

..... Answer on **Fig. 19.2** .....**[1]**

(iii) A diagram of a moss sperm is shown in Fig. 19.3.

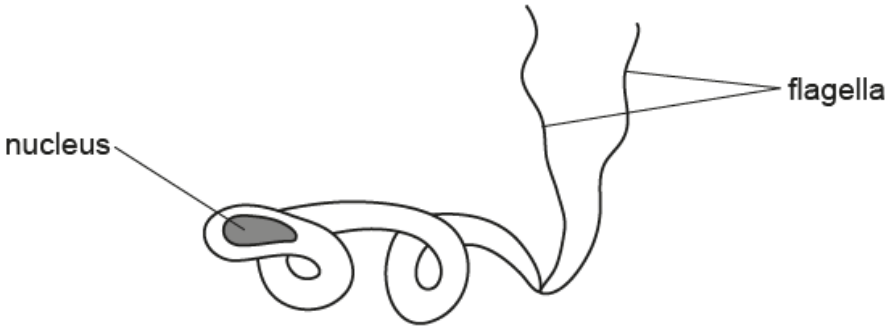

Fig. 19.3

The flagella allow the sperm to move towards an egg.

Suggest and explain another adaptation that is likely to be present in these sperm cells.

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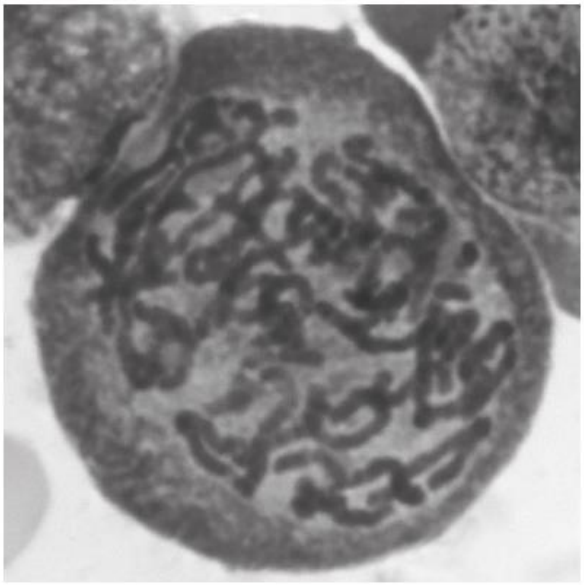
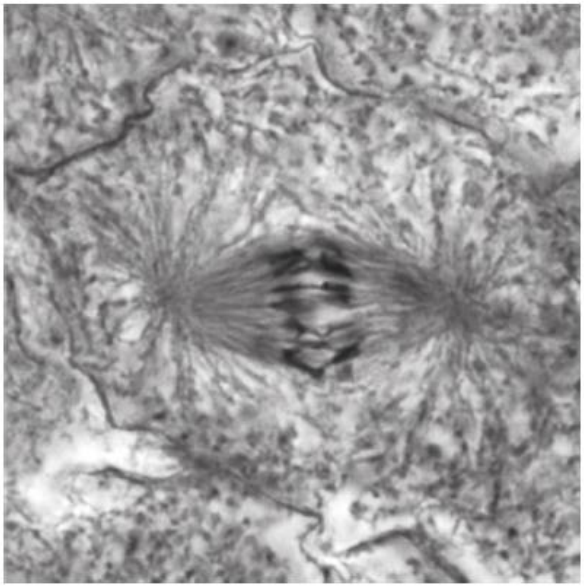
3. Nov/2021/Paper_H420/03/No.2

(a)* **Fig. 2.1** shows three images, **C** to **E**, of animal cells undergoing mitosis.

C



D



E

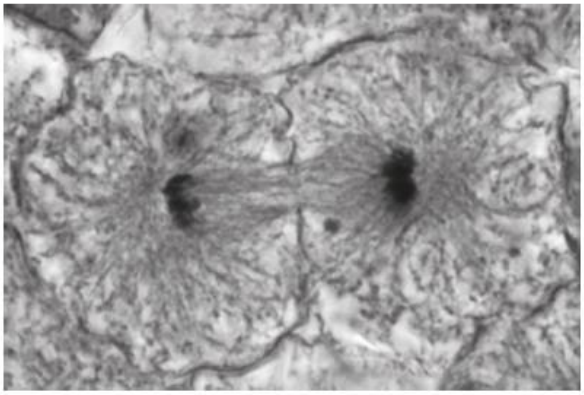


Fig. 2.1

Describe the events taking place in cells **C**, **D** and **E**.

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..... **[6]**

(b) The eukaryotic cell cycle is regulated by three checkpoints. Mutations can occur in genes that control the cell cycle checkpoints.

Scientists recorded observations of two different tissues.

(i) In one tissue, the scientists found a genetic mutation that stopped the metaphase checkpoint from working.

Suggest an abnormality the scientists might observe in the cells of this tissue.

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..... **[1]**

(ii) In the other tissue, the scientists observed cells with chromosomes that had been replicated despite containing damaged DNA.

Suggest which cell cycle checkpoint is no longer working in this tissue **and** justify your answer.

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..... **[1]**

(c) Mitosis does not occur in bacteria. Bacterial cells divide using binary fission. Binary fission is shown in **Fig. 2.2**.

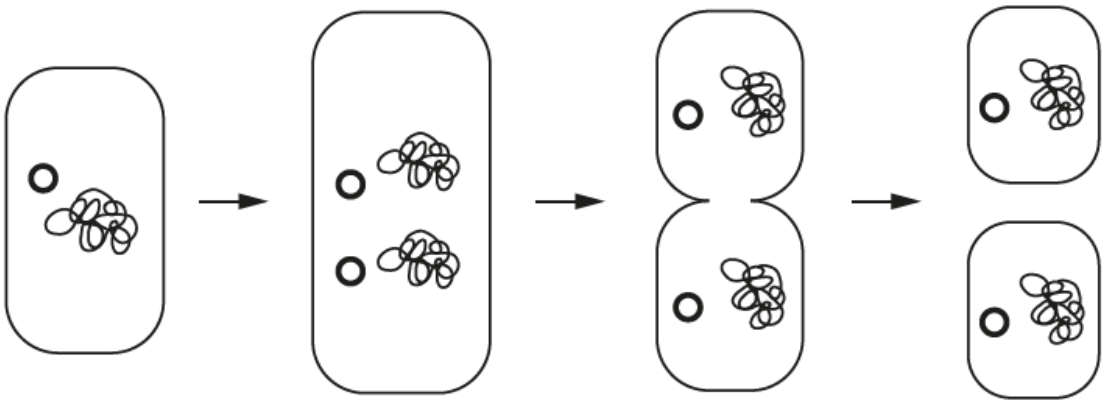

Fig. 2.2

Bacteria do not have a nucleus.

Describe **two other** differences between how DNA is separated during binary fission and mitosis.

1 .....

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2 .....

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[2]

4. Nov/2020/Paper_H420/03/No.4(a)

(a) Prokaryotic cells have cytoskeletons. The molecules in prokaryotic cytoskeletons are different from the molecules in eukaryotic cytoskeletons.

Table 4.1 lists three molecules present in a prokaryotic cytoskeleton.

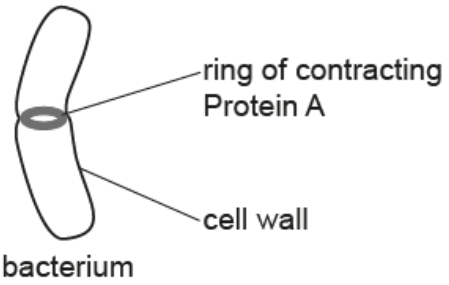
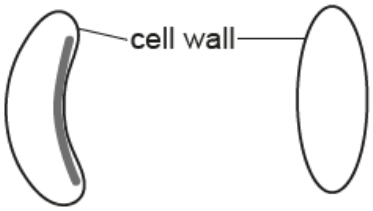
Prokaryotic cytoskeleton molecule	Information
Protein A	
Protein B	Similar structure to actin.
Protein C	

Table 4.1

(i) Suggest the function of Protein A.

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(ii) Suggest the function of Protein C.

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(iii) An antibiotic called A22 binds irreversibly to Protein B. Despite its antibiotic properties, A22 is not used in humans.

Suggest why scientists have advised that A22 should not be used in humans.

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