



Cells (Continuity and change) practice questions

10 questions • 31 marks • mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 31

Cell and nuclear division **Spec D2.1**

1 PAPER 1A STYLE [1 mark]

What achieves the splitting of the cytoplasm during cytokinesis in a plant cell?

- A. ☐ A ring of contractile actin and myosin proteins pinching the cell membrane inwards
- B. ☐ Vesicles that assemble sections of membrane and cell wall across the cell
- C. ☐ Spindle microtubules pulling the two halves of the cell apart
- D. ☐ The nuclear membrane re-forming across the middle of the cell

2 PAPER 1A STYLE [1 mark]

In a micrograph of a root tip, a cell shows two groups of V-shaped chromosomes moving towards opposite poles. Which phase of mitosis is the cell in?

- A. ☐ Prophase
- B. ☐ Metaphase
- C. ☐ Anaphase
- D. ☐ Telophase

3 PAPER 1A STYLE [1 mark]

An organism has a diploid number of 8. How many different combinations of chromosomes can be produced in its gametes by random orientation of bivalents alone?

- A. ☐ 4
- B. ☐ 8
- C. ☐ 16
- D. ☐ 256

4 PAPER 2A STYLE [3 marks]

Explain why cytokinesis is usually equal, and outline one example of unequal cytokinesis.

5 PAPER 2A STYLE

[4 marks]

Explain how non-disjunction can lead to a child with Down syndrome.

[illegible]

6 PAPER 2B STYLE

[7 marks]

Explain how meiosis halves the chromosome number and produces genetically different haploid nuclei.

[illegible]

Water potential Spec D2.3

7 PAPER 1A STYLE

[1 mark]

A cell is placed in a solution that is isotonic to its cytoplasm. Which statement is correct?

- A. ☐ No water molecules cross the cell membrane
- B. ☐ Water moves into and out of the cell at equal rates
- C. ☐ Water moves into the cell faster than it leaves
- D. ☐ Water moves out of the cell faster than it enters

8 PAPER 2A STYLE

[3 marks]

Explain how sodium chloride and glucose dissolve in water.

[illegible]

Potato cylinders were placed in sucrose solutions for 60 minutes. Five repeats were done at each concentration (the data are for practice). (a) Calculate the percentage change in mass of a cylinder that went from 1.60 g to 1.76 g. [1] (b) Using the means, estimate the isotonic sucrose concentration of the potato tissue, showing how you did this. [2] (c) State what the standard error indicates and deduce which concentration gave the least reliable mean. [2] (d) Suggest one variable that should be controlled. [1]

Percentage change in mass of potato cylinders		
Sucrose concentration / mol dm ⁻³	Mean percentage change in mass / %	Standard error / %
0.0	+18.0	1.1
0.2	+7.5	0.9
0.4	-3.0	2.6
0.6	-11.5	1.0
0.8	-17.0	1.2

Answer =

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Compare and contrast the effects of a hypotonic medium on a red blood cell and on a plant cell, and explain why fluids given intravenously are isotonic.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B

2. [1]

C C

3. [1]

C C ($2^4 = 16$, since $n = 4$)

4. [3]

- each daughter cell must receive at least one mitochondrion / chloroplast / organelles that can only be made by division of pre-existing ones [1]
- each daughter cell receives a nucleus / enough cytoplasm to survive OWTTE [1]
- oogenesis: almost all cytoplasm passes to the (secondary) oocyte / ovum, small polar bodies formed [1]
- OR budding in yeast: a small bud receives a nucleus and pinches off from the larger parent cell [1]
- max 3

5. [4]

- non-disjunction is failure of chromosomes / chromatids to separate in meiosis [1]
- homologous chromosomes fail to separate in meiosis I / sister chromatids fail to separate in meiosis II [1]
- a gamete receives two copies of chromosome 21 / 24 chromosomes [1]
- fertilised by a normal gamete with 23 chromosomes [1]
- zygote has three copies of chromosome 21 / trisomy 21 / 47 chromosomes [1]
- max 4

6. [7]

- DNA is replicated before meiosis so each chromosome has two (sister) chromatids [1]
- chromosomes condense by supercoiling (around histones) [1]
- homologous chromosomes pair to form bivalents in prophase I [1]
- crossing over between non-sister chromatids at chiasmata [1]
- produces new combinations of alleles / recombinant chromatids [1]
- bivalents line up at the equator in metaphase I in random orientation [1]
- orientation of each bivalent is independent of the others, giving 2^n combinations [1]
- spindle microtubules / motor proteins move chromosomes to the poles [1]
- homologous chromosomes separate in meiosis I / first segregation, halving the chromosome number [1]
- sister chromatids separate in meiosis II / second segregation [1]
- four haploid nuclei are produced from one diploid nucleus [1]
- max 7

7. [1]

B B

8. [3]

- water molecules are polar / have $\delta+$ hydrogen and $\delta-$ oxygen [1]
- Na^+ ions are attracted to the $\delta-$ oxygen of water molecules [1]
- Cl^- ions are attracted to the $\delta+$ hydrogen of water molecules [1]
- glucose is polar and forms hydrogen bonds with water molecules [1]
- each solute particle becomes surrounded by water molecules / solvation [1]
- max 3

9. [6]

- (a) $(1.76 - 1.60) \div 1.60 \times 100 = +10\%$ [1]
- (b) isotonic point is where percentage change is zero / line crosses the x-axis [1]
- between 0.2 and 0.4 mol dm^{-3} , about 0.34 mol dm^{-3} [1] Accept 0.32 – 0.36
- (c) standard error shows how precisely the mean is known / how close the sample mean is likely to be to the true mean [1] Do not accept spread of the data alone (that is standard deviation)
- 0.4 mol dm^{-3} , as it has the largest standard error [1]
- (d) one of: temperature / size or surface area of cylinders / source of potato / time / volume of solution / blotting method [1]

10. [4]

- both: water enters the cell by osmosis [1]
- red blood cell swells and may burst / haemolysis, as it has no cell wall [1]
- plant cell becomes turgid / develops turgor pressure, but the cell wall prevents bursting [1]
- isotonic IV fluids cause no net water movement into or out of blood cells [1]
- so blood cells do not burst or crenate / shrink [1]
- max 4