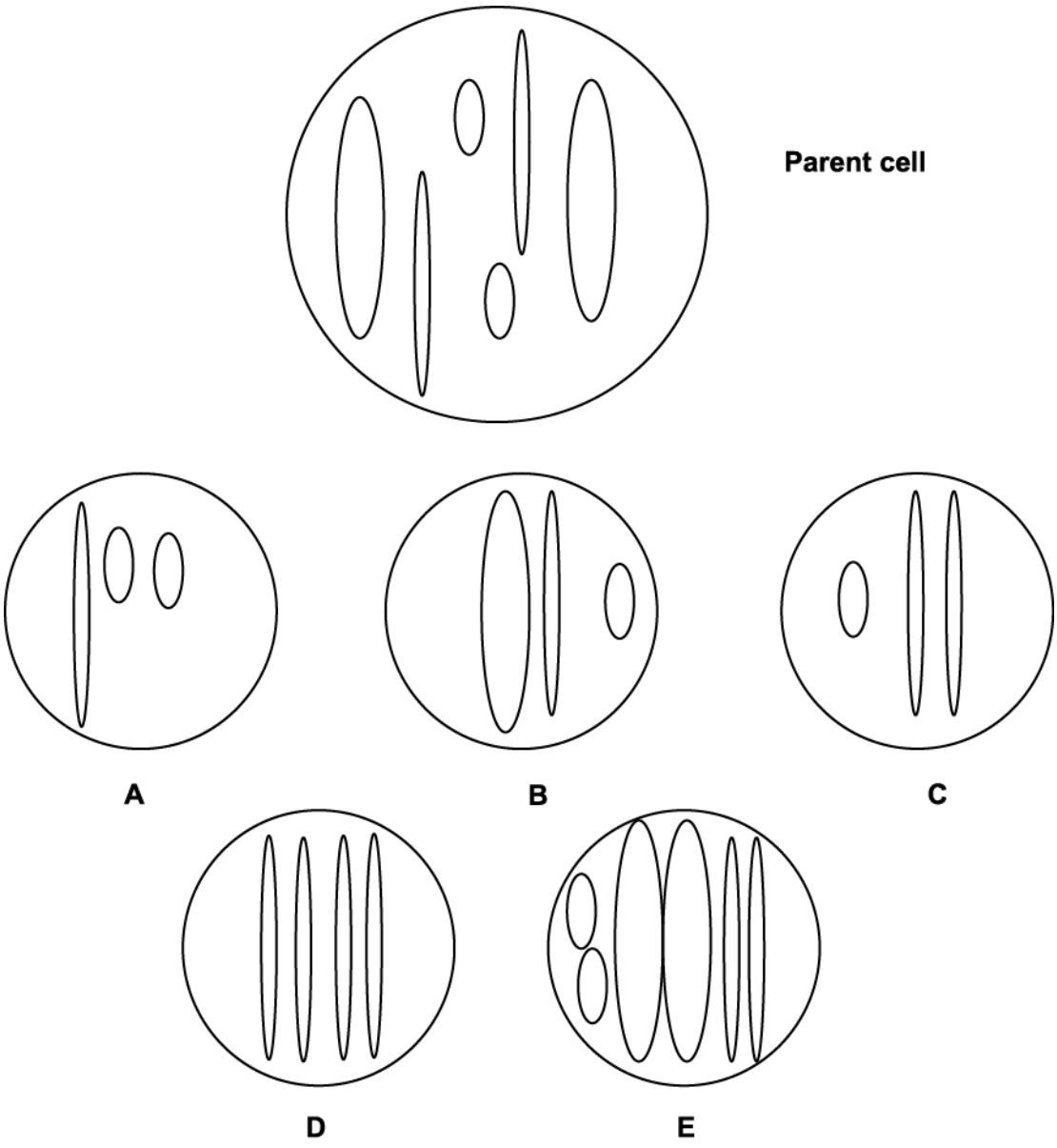
1(a). Cells divide by mitosis or meiosis.

The diagram below shows a parent cell containing chromosomes.

Cells **A**, **B**, **C**, **D** and **E** are possible daughter cells that **could** result from either mitosis or meiosis.



Complete the table by identifying the daughter cell that correctly shows the result of each type of cell division. Write the letter of the daughter cell in the column headed “Correct daughter cell”.

Give reasons for your choice in the table.

Type of cell division	Correct daughter cell	Reasons for your choice
Mitosis		1.
Meiosis		1.
		2.

[5]

(b). A newt is a type of amphibian.

It can grow a new leg if one is damaged or bitten off by a predator.

What type of cell division does the newt use to grow a new leg?

---

[1]

2. Cell division by mitosis only happens in certain regions of a plant.

What are these regions called?

Put a tick (✓) in the box next to the correct answer.

leaves ☐

phloem ☐

meristems ☐

xylem ☐

[1]

3(a). After fertilisation in humans, the cell divides and an embryo develops.

(i) After which cell stage do the cells in a human embryo stop being identical?

Draw a (ring) around the correct answer.

2 4 8 16 32

[1]

(ii) Cells found in an early embryo are called stem cells.

Scientists think these stem cells could be used to treat some diseases.

Which of the following statements explain why scientists think this?

Place ticks (✓) in the boxes next to the **two** correct statements.

Stem cells are the same as an egg cell. ☐

Stem cells are unspecialised cells. ☐

Stem cells cannot specialise. ☐

Stem cells can become any type of cell. ☐

Stem cells must be fertilised to become specialised. ☐

[2]

(b). In mitosis one cell divides to form two new cells.

In a human embryo this doubling time is approximately 30 hours.

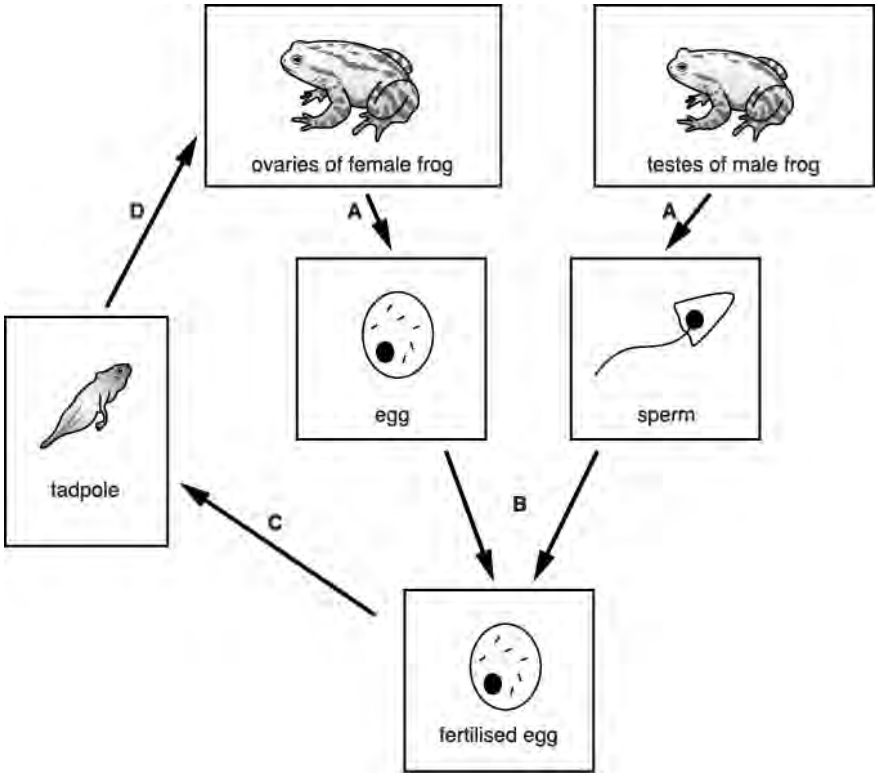
How long would it take for a fertilised egg cell to become an 8 cell embryo?

Draw a (ring) around the correct answer.

30 hours 60 hours 90 hours 120 hours

[1]

4(a). The diagram below shows the life cycle of a frog.



Look at the diagram of the life cycle.

(i) At which part of the life cycle, stage **A**, **B**, **C** or **D**, will meiosis take place?

stage _____ **[1]**

(ii) A cell taken from the eye of a frog has 26 chromosomes.

How many chromosomes will there be in a cell taken from a leg of the same frog?

Place a tick (✓) in the box next to the correct answer.

13 ☐

26

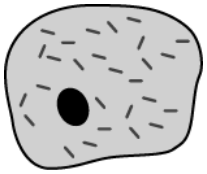
	☐
46	☐
52	☐

[1]

(iii) Chromosomes are located in the nucleus of the cell.

Draw a labelled line to the nucleus on the diagram of the cell.

[1]



(iv) Only 4% of the eggs produced by a frog will be fertilised and become tadpoles.

If the frog produces 2100 eggs, how many of these eggs would you expect to develop into tadpoles?

Show your working.

number of tadpoles _____ **[2]**

(b). When the nucleus from a sperm cell and egg cell fuse, a zygote is formed.

Which statement describes what the zygote will contain?

Put a tick (✓) in the box next to the correct answer.

a set of chromosomes from each parent ☐

only chromosomes from the female parent ☐

more chromosomes from the mother than from the male parent ☐

no chromosomes from either parent ☐

[1]

5(a). Emily and Carmel are identical twins.

The twin girls are formed from the division of a zygote (fertilised egg).

This zygote divides into two cells, which then separate.

Name the type of cell division involved when the zygote divides into two cells.

_____ [1]

(b). These cells complete the cell cycle many times to form separate embryos.

Describe the main processes of the **cell cycle**.

---[3]

6(a). What is the name of the type of cell division that produces gametes?

Put a ring around the correct name.

fertilisation **meiosis** **mitosis** **replication** **specialisation**

[1]

(b). The **cell cycle** consists of two stages, cell growth and cell division.

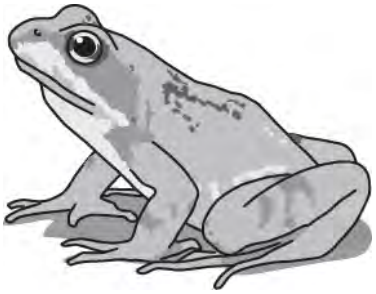
Put ticks (?) in **four** boxes to indicate when the processes occur.

Process	Cell growth	Cell division
nucleus splits into two	☐	☐
numbers of organelles increase	☐	☐
chromosomes are copied	☐	☐
copies of the chromosomes separate	☐	☐

[4]

7. Frogs grow by producing new body cells.

Adult frogs reproduce sexually by making sex cells (gametes).



Describe how body cells and sex cells are made.

The quality of written communication will be assessed in your answer.

[6]

8(a). During sexual reproduction a sperm cell fertilises an egg cell.

What is this fertilised egg cell called?

Put a tick (?) in the box next to the correct answer.

embryo ☐

zygote ☐

fetus ☐

gamete ☐

[1]

(b). The fertilised egg divides to form 2 cells.

These 2 cells divide to form 4 cells.

These 4 cells divide to form 8 cells.

How many divisions are needed to form a group of 128 cells from one fertilised egg?

Show your working.

answer = _____ divisions. **[2]**

(c). After how many divisions will the cells start to become specialised?

answer = _____ **[1]**

(d). Some cells remain unspecialised.

Write down the name of these cells and what may happen to them at a later time.

---[2]

END OF QUESTION PAPER

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>
<table>
<tr><th>Type of cell division</th><th>Correct daughter cell</th><th>Reasons for your choice</th></tr>
<tr><td>Mitosis</td><td>E ✓</td><td>1. Identical to parent ✓</td></tr>
<tr><td rowspan="2">Meiosis</td><td rowspan="2">B ✓</td><td>1. Half the number of chromosomes ✓</td></tr>
<tr><td>2. One of each pair ✓</td></tr>
</table>
</td><td>5</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>Mitosis ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>Meristems ✓</td><td>1</td><td>Examiner's Comments

A sizeable minority of candidates recognised meristems as the regions in a plant where mitosis takes place.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>3</td><td>a</td><td>i</td><td>8</td><td>1</td><td>Examiner's Comments

This question asked for the cell stage when cells in a human embryo stop being identical. It was not well known and only a minority scored.</td></tr>
<tr><td></td><td></td><td>ii</td><td>the stem cells are unspecialised cells ✓

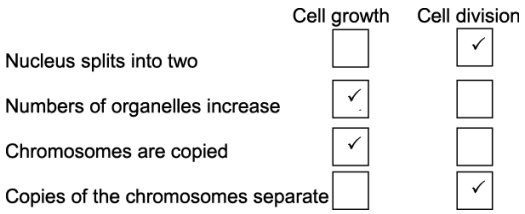
the stem cells can become any type of cell ✓</td><td>2</td><td>Examiner's Comments

Candidates were required to identify correct reasons why scientists think stem cells can be used to treat diseases. Most could select at least one correct reason.</td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance
	b		90 hours	1	Examiner's Comments Candidates were given the doubling time for mitosis in a human embryo and were required to calculate how many hours it would take to reach the 8-cell stage. Only a minority selected the correct response.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
4	a	i	A	1	accept correct indication on diagram Examiner's Comments Very few candidates were able to identify at which stage in the life cycle of a frog meiosis takes place. The most common wrong answer selected was at fertilisation.
		ii	13 ☐ 26 ✓ 46 ☐ 52 ☐	1	Examiner's Comments The majority of candidates appreciated that the number of chromosomes in a leg cell of a frog would be the same as in a cell from the eye.
		iii	nucleus to be correctly labelled	1	**Accept** arrows (either direction) **Accept** correct line without word nucleus Examiner's Comments This question required candidates to label the nucleus on a diagram of a cell. This was very well answered.
		iv	84 (2)	2	award one mark for the correct working (e.g. 2100 × 4/100) Examiner's Comments Candidates were told that 4% of frog eggs develop into tadpoles and were asked to calculate how many of 2100 eggs would become tadpoles. The majority could calculate this successfully, and a very small number gained 1 mark for correct working only.

Question			Answer/Indicative content	Marks	Guidance
	b		a set of chromosomes from each parent ✓	1	**Examiner's Comments** Almost all candidates knew that a zygote contains a set of chromosomes from each parent.
			Total	6	
5	a		mitosis	1	**Examiner's Comments** This question revealed that a surprisingly large proportion of the candidates were unable to correctly recall the term “mitosis” for one mark.
	b		**any three from** **cell growth** numbers of organelles increase; chromosomes are copied **mitosis** copies of the chromosomes separate; the **nucleus** divides	3	**accept** unqualified cell growth = 1 max. mark for this area accept gets bigger, increases in size accept DNA is copied **accept** unqualified mitosis = 1 max. for this area accept DNA divides / splits **Examiner's Comments** The same apparent confusion was apparent as in part (a) as candidates were largely lacking in clear and confident descriptions of the phases of the cell cycle and the place of mitosis in it. This has been noted as a weak area in previous examination sessions.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
6	a		Meiosis	1	<u>Examiner's Comments</u> Only a minority of candidates were able to identify meiosis as the term for the type of cell division producing gametes, common wrong answers being mitosis and fertilisation.
	b			4	1 mark for each correct row <u>Examiner's Comments</u> Candidates were able to score well on this question – 4 marks were available for identifying whether processes were part of cell growth or cell division.
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
7			[Level 3] Includes good description of both mitosis and meiosis and makes reference to chromosomes. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Correctly names both meiosis and mitosis linked to correct processes OR correctly identifies one process and gives a good description. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Refers to cell division. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to C Indicative scientific points about meiosis may include: • a type of cell division that produces gametes. • cells produced have half the number of chromosomes of parent cell Indicative scientific points about mitosis may include: • produces body cells. • copies of chromosomes separate • nucleus divides • cells are genetically identical to each other. • cells are genetically identical to parent cells. Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments The question was sometimes well answered by those who could name both mitosis and meiosis. Candidates also needed to be able to develop their answers with descriptions of what happens to the chromosomes in each of the processes.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
8	a		<table><tr><td>embryo</td><td></td></tr><tr><td>zygote</td><td>✓</td></tr><tr><td>fetus</td><td></td></tr><tr><td>gametes</td><td></td></tr></table>	1	**Examiner's Comments** The question required the response 'zygote', where this was not given the most common incorrect response by far was 'embryo'.
	b		Idea of doubling shown; 7;	2	correct answer 7 alone scores 2 marks **Examiner's Comments** Candidates found this a challenging question which required them to double the number of bacteria each generation. Many responses were 6 or 8 rather than the correct 7, but credit for doubling could only be given where there was evidence of working out on the paper.
	c		3;	1	**Examiner's Comments** Candidates needed recall of the fact of specialisation after the 8 cell stage, and the realisation that this represents three doublings. The question was very challenging, and the most common response seems to be 8.
	d		stem cells; Specialise at a later time;	2	**accept** change into other cells / named example **Examiner's Comments** This question was challenging in requiring the unprompted response of stem cells along with the idea that they would specialise at a later stage. It was most common to see descriptions of later specialisation scoring one of the marks.
			Total	6	