

Stem cells, gene expression and phenotype: practice questions

10 questions · 34 marks · mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 34

1 UNIT 2 STYLE [1 mark]

Which of the following is formed by the cleavage of a zygote into a solid ball of cells?

- A. ☐ Blastocyst
- B. ☐ Morula
- C. ☐ Inner cell mass
- D. ☐ Trophoblast

2 UNIT 2 STYLE [1 mark]

Which statement about histone acetylation is correct?

- A. ☐ It makes the DNA wind more tightly and switches off the gene
- B. ☐ It loosens the DNA from the histones and allows the gene to be transcribed
- C. ☐ It changes the sequence of bases in the gene
- D. ☐ It removes the introns from the pre-mRNA

3 UNIT 2 STYLE [3 marks]

Explain what is meant by the terms stem cell and pluripotent.

4

UNIT 2 STYLE

[6 marks]

Discuss the ways in which society uses scientific knowledge to make decisions about the use of embryonic stem cells in medical therapies.

5

UNIT 2 STYLE

[4 marks]

A pancreatic cell and a muscle cell from the same person contain the same genes. Explain how they become different in structure and function.

6

UNIT 2 STYLE

[4 marks]

Explain how one gene can give rise to more than one protein.

7

[5 marks]

[illegible]

8

[2 marks]

.....

.....

.....

9

[4 marks]

[illegible]

The table shows the heights of 100 students. Describe the pattern shown by the data, identify the modal class and explain what causes this type of variation.

Heights of 100 students	
Height range (cm)	Number of students
150 to 154	4
155 to 159	14
160 to 164	30
165 to 169	32
170 to 174	15
175 to 179	5

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]

B B

3. [3]

- stem cell: an undifferentiated cell (1)
- that can divide by mitosis / self-renew and differentiate into specialised cells (1)
- pluripotent: can differentiate into almost any / many types of cell in the body, but not extra-embryonic (placental) cells (1)
- Max 3

4. [6]

- scientists provide evidence about the potential benefits, for example treating diseases such as diabetes / spinal injury (1)
- and about the risks, for example tumour formation / rejection (1)
- ethical objections: embryo destroyed / embryo has the right to life (1)
- religious / moral views differ (1)
- spare IVF embryos would be destroyed anyway (1)
- laws / regulatory bodies license and control the research (1)
- decisions use the evidence together with public opinion / ethics committees (1)
- alternatives such as adult stem cells may avoid the ethical issue (1)
- Max 6

5. [4]

- different genes are expressed / switched on in each cell (1)
- only these genes are transcribed to produce (active) mRNA (1)
- mRNA is translated into different proteins (1)
- proteins act as enzymes that control cell processes / determine the cell's structure (1)
- for example the pancreatic cell expresses the insulin gene, the muscle cell expresses the actin and myosin genes (1)
- Max 4

6. [4]

- gene is transcribed to give pre-mRNA containing introns and exons (1)
- introns are removed and exons joined (splicing) (1)
- post-transcriptional change / happens before translation (1)
- exons can be joined in different combinations / some exons left out (alternative splicing) (1)
- different mature mRNAs are made and translated into different proteins (1)
- Max 4

7. [5]

- DNA methylation: methyl groups added to cytosine bases (1)
- this prevents transcription / switches the gene off (1)
- histone modification: acetylation loosens the DNA so the gene can be transcribed (1)
- deacetylation / (some) histone methylation makes the DNA more tightly wound so the gene is not transcribed (1)
- the DNA base sequence is not changed (1)
- methylation pattern copied on to the new DNA after replication, so passed on to daughter cells (1)
- Max 5

8. [2]

- phenotype is the result of the interaction of genotype and the environment (1)
- different diets / lifestyles / environments affect gene expression, for example by epigenetic changes (1)

9. [4]

- gametes of man: I^A and I^O (1)
- gametes of woman: I^A and I^B (1)
- offspring genotypes $I^A I^A$, $I^A I^B$, $I^A I^O$, $I^B I^O$ (1)
- probability of group B ($I^B I^O$) = $\frac{1}{4}$ / 25% (1)

10. [4]

- bell-shaped / normal distribution, with most students near the middle and fewer at the extremes (1)
- modal class is 165 to 169 cm (1)
- continuous variation caused by many genes (polygenic), each with a small additive effect (1)
- plus environmental effects such as diet / nutrition (1)
- a range of heights with no distinct categories / heights are measured, not counted (1)
- Max 4