PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 7: MODERN GENETICS

STEM CELLS

SCORE	PERCENTAGE
/35	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions and mark schemes in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question or mark scheme material in this pack. Pearson has not endorsed, approved or been involved in the production of it. Pearson, Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson publishes its past papers and mark schemes free of charge. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	{methyl group / CH_3} added to a {base (cytosine or adenine) / cytosine / adenine / CpG site}	DO NOT ACCEPT between cytosine and guanine ACCEPT A for adenine, C for cytosine, G for guanine	

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to the following: • {zygote / morula} are totipotent stem cells as they give rise to all cell types (1) • {blastocyst / inner cell mass} contains pluripotent cells that give rise to the cells of the embryo (and not the extra embryonic tissue) / most cell types (1) • cells in the developing embryo are multipotent as they become only some cell types (1)	ACCEPT references to early and late stages of development if clear from description which stages are being referred to ACCEPT cleavage cells ACCEPT {trophoblastic cells / cells around the outside of the blastocyst} as they become extra embryonic tissue N.B. If correct description given for 2 or more types of stem cell but no reference to embryo, award 1 mark	

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to two of the following: • level of DNA methylation increases after the blastocyst stage} (1) • because genes {switched off / silenced / inactivated / cannot be transcribed / cannot be expressed} (1) • causing cells to become {specialised / differentiated} (1)		

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • demethylation might result in a gene being activated (1) • therefore transcription of the gene takes place, producing protein that causes change in the fibroblast cells (1)		**(2)**

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • great potential importance or medical implications of the research (1) • this outweighs concerns around the use of { invertebrates due to less developed nervous system / embryos have no nervous system } (1)		**(2)**

Q4.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • because they are (fully) differentiated cells (1) • therefore genes needed (for other cell types) are (permanently) {switched off / silenced} (1) • therefore proteins needed by other cell types cannot be produced (1)	ACCEPT specialised ACCEPT not able to express certain genes	

Q5.

Question Number	Answer	Additional guidance	Mark
(a)	D		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	A description that makes reference to the following: • {fibroblasts / non-pluripotent cells / somatic cells} are used (1) • {specific / reprogramming } {genes / transcription factors / miRNAs} are put into the cells (1) Plus one of the following: • credit named gene, e.g. Oct4 (Pou5f1), Sox2, cMyc, or Klf4 (1) • using a {vector / virus} (1) • cells are cultured (1)		**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	A description that makes reference to the following: • replace the dysfunctional cells with functional cells derived from iPS cells (1) • iPS cells are injected into the retina and then develop into normal retinal cells (1)		**(2)**

Q6.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following points: • examine cells from different tissues in the mature sea urchin, under a microscope (1) • cells descended from the repositioned cell are fluorescent due to traces of the dye injected (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • the cell was (still) pluripotent (1) • therefore cell signalling in the new position could determine the fate of the cell (1) • causing activation of transcription factors for transcription of genes relevant to the new position (1) • leading to synthesis of proteins for development into different tissue (1)	Allow totipotent	**(4)**

Q7.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	An explanation that makes reference to the following: • mutation had removed defective gene but the cell continued to multiply (1) • therefore functioning white blood cells produced and immune system was restored to normal functioning (1)		**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • fetal stem cells will be pluripotent (1) • therefore they are able to develop into a wider range of cell types (1)		**(2)**

Q8.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to five of the following, including at least one similarity or one difference : <u>Similarities</u>: • both have the potential to divide indefinitely **(1)** • both have the potential to differentiate into a number of cell types **(1)** <u>Differences</u>: • iPS cells were {adult cells / named example of adult cell} but embryonic stem cells are cells taken from the {morula / inner cell mass} **(1)** • iPS have a {gene / named gene} added but embryonic cells do not **(1)** • there are {no / less / different} ethical issues surrounding the use of iPS cells **(1)** • iPS cells can form adult cells whereas embryonic cells form younger cells **(1)** • iPS cells will produce patient-matched cells but embryonic stem cells will be antigenic **(1)**	**NB** do not piece together **Accept** have no Hayflick limit **Accept** to specialise e.g. fibroblasts, keratinocytes, kidney epithelium, blood cells **Accept** blastomeres / early embryo (up to 14 days) e.g. Oct4, Sox2, cMyc, KIf4 **Accept** there will be rejection issues using embryonic stem cells but not using iPS cells	**(5)**

Q9.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • to produce lots of {genetically identical / hybridoma} cells **(1)** • so that lots of antibodies (of one type) can be produced (by hybridoma cells) **(1)** • so that the hybridoma cells can divide **(1)**	**Accept** because a {fully-differentiated / antibody-producing / plasma} cell cannot divide	**(2)**