PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 7: MODERN GENETICS

STEM CELLS

SCORE	PERCENTAGE
/35	%

STEMUP

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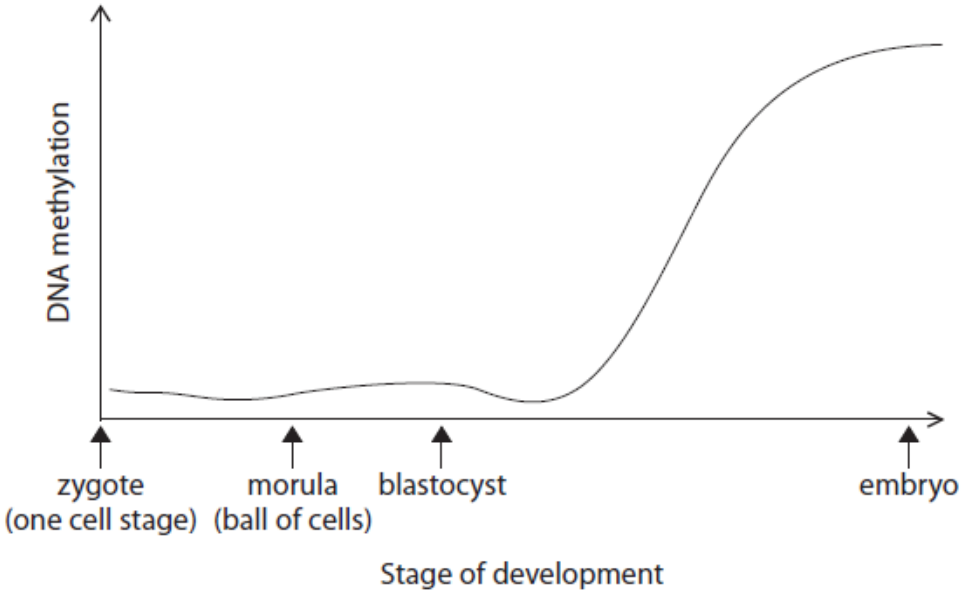
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Q1.

Epigenetic modifications are involved in the development of an embryo.

The graph shows the changes in DNA methylation during the development of an embryo from a zygote.



(i) State the meaning of the term DNA methylation.

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(ii) Describe the differences between totipotent, pluripotent and multipotent

stem cells during the development of an embryo.

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(iii) Analyse the graph to explain why DNA methylation is involved in the development of an embryo.

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(Total for question = 6 marks)

Q2.

Mouse embryonic fibroblasts can be converted into F-class ('fuzzy') pluripotent cells.

Scientists have shown that DNA demethylation may be involved in this conversion.

Explain how demethylation of DNA might cause this conversion.

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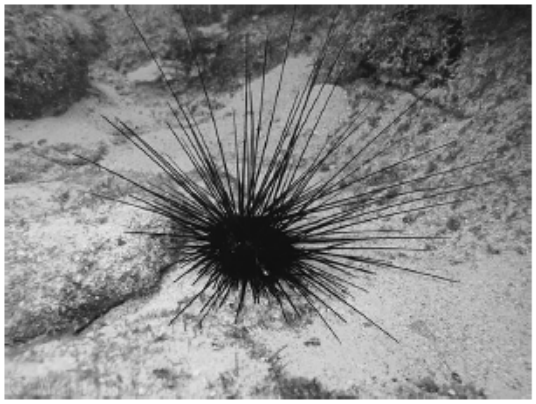
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Q3.

A sea urchin is an invertebrate animal that lives on the seabed.

The photograph shows a sea urchin.



Sea urchin embryos are often used to study embryonic development.
In the early stages of embryonic development, a sea urchin embryo is similar to a mammalian embryo.

Explain why the use of sea urchin embryos was approved by an ethics committee.

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Q4.

Explain why some cells are not able to become other cell types.

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(Total for question = 2 marks)

Q5.

Retinitis pigmentosa is a genetic eye disease that affects rod cells. The disease results in night blindness and sight defects.

Induced pluripotent stem cells (iPS cells) are being used by scientists studying this disease.

(a) Which of the following is correct for a pluripotent cell?

(1)

	Is obtained from	Can differentiate into
☒ **A**	early embryo	any cell type
☒ **B**	early embryo	limited cell types
☒ **C**	late embryo	any cell type
☒ **D**	late embryo	limited cell types

(b) Describe how iPS cells can be produced.

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(c) Describe how iPS cells could be used to cure retinitis pigmentosa.

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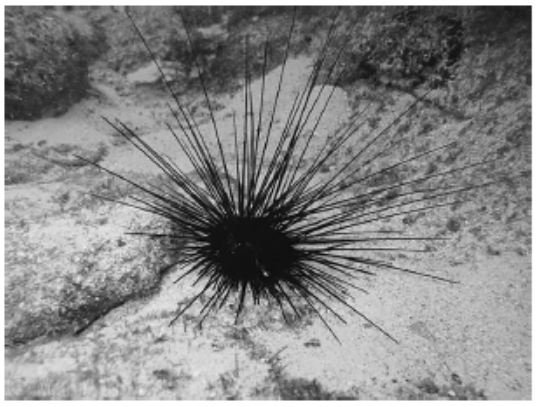
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(Total for question = 6 marks)

Q6.

A sea urchin is an invertebrate animal that lives on the seabed.

The photograph shows a sea urchin.



Sea urchin embryos are often used to study embryonic development.
In the early stages of embryonic development, a sea urchin embryo is similar to a mammalian embryo.

A scientist carefully removed one of the 128 cells from the hollow structure and injected fluorescent dye into its cytoplasm

She replaced this cell in a new position on the opposite side of the hollow structure.

The embryo then developed normally. The repositioned cell formed healthy tissue, appropriate to its new position.

The tissue formed by an embryonic cell is called the 'fate' of the cell.

(i) Explain how the scientist could identify the fate of the repositioned cell.

(2)

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(ii) The scientist found that repositioning this cell changed its fate.

Explain the scientist's finding.

(4)

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Q7.

The photograph shows the hand of a person with the inherited condition 'WHIM'.



This condition results in a defective immune system, warts on the skin surface and an increased risk of cancer.

A woman had WHIM but her symptoms disappeared. However, she was worried that she had passed the condition on to her children.

Bone marrow is responsible for making white blood cells.

Scientists found that the woman had a single mutation in a bone marrow stem cell. This caused 'chromosome shattering' with the loss of 164 genes, including the defective gene.

(i) Explain how this mutation in a bone marrow stem cell had cured her of WHIM.

(2)

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(ii) Some people have complained about the use of stem cells from fetal cell lines in the development of Ebola vaccines.

Explain why these stem cells are being used to produce vaccines rather than bone marrow cells.

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Q8.

Scientists are developing ways of using stem cells to replace heart cells that have been damaged as a result of heart disease.

Both embryonic stem cells and induced pluripotent stem cells (iPS cells) can be used to create new heart cells.

Compare and contrast the properties and uses of embryonic stem cells with those of iPS cells.

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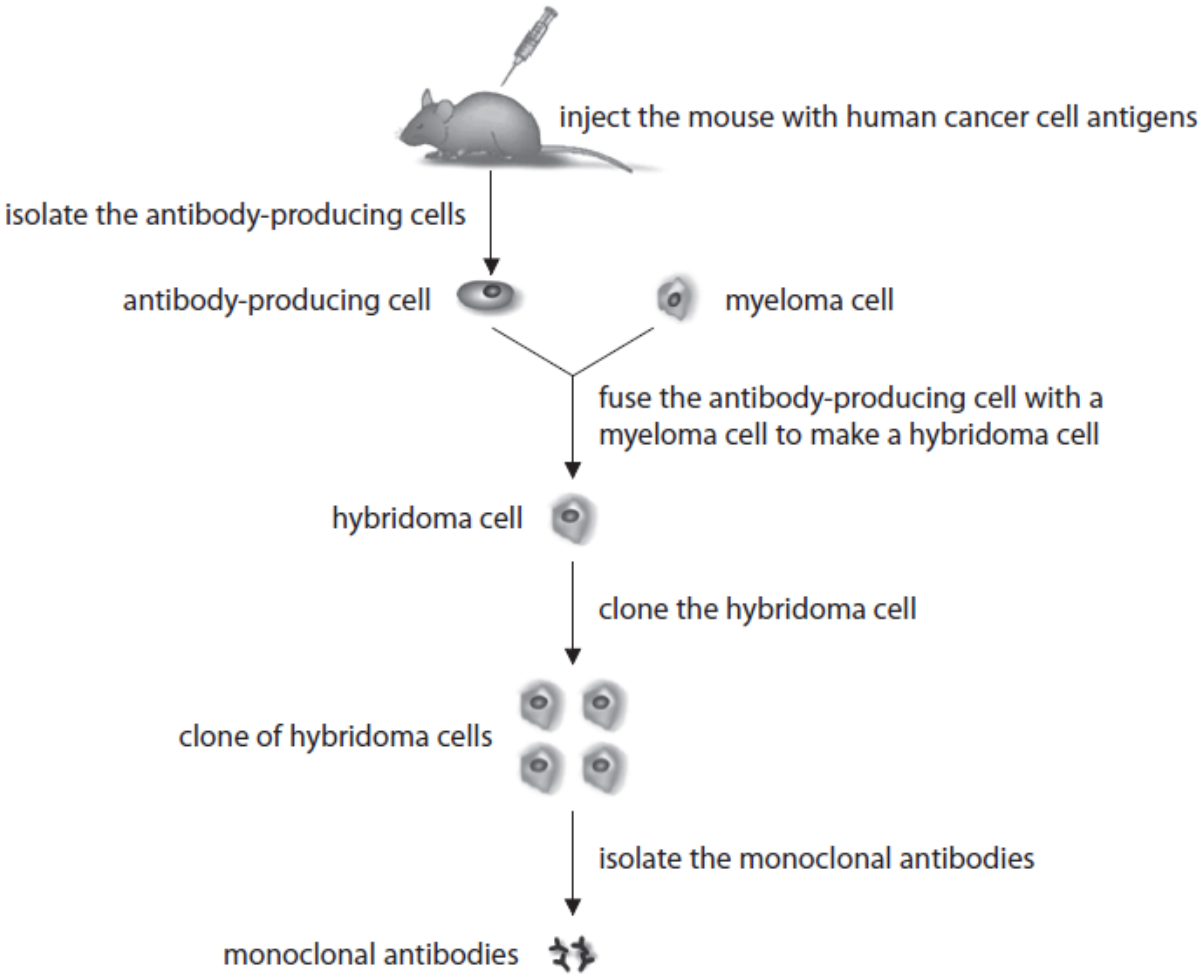
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Q9.

Monoclonal antibodies can be made against a wide range of different antigens. They are used in research and medicine.

Monoclonal antibodies are made by fusing an antibody-producing cell with a myeloma cell.

The diagram shows some of the steps involved in making monoclonal antibodies against human cancer cell antigens.



Myeloma cells have the potential to divide indefinitely.

Explain why myeloma cells are used in the production of monoclonal antibodies.

(2)

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(Total for question = 2 marks)