Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE in A Level Biology

Topic 7: Modern Genetics

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1

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

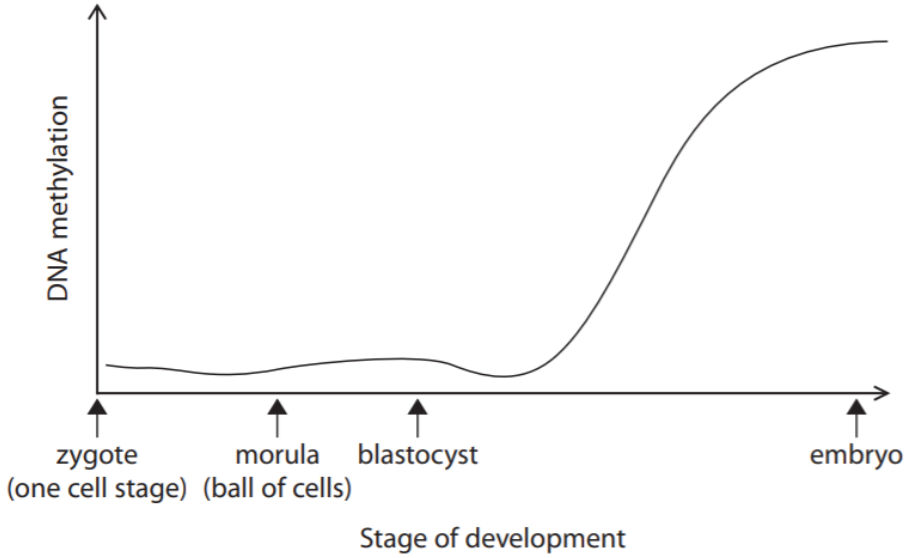
Compare and contrast the properties and uses of embryonic stem cells with those of iPS cells.

(5)

2

(a) 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.

(1)

(ii) Describe the differences between totipotent, pluripotent and multipotent stem cells during the development of an embryo.

(3)

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

(2)

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

(2)

3

Soya beans are an important crop for the production of food and oil.

(a) In the 2012 to 2013 growing season, production of soya beans was highest in the United States and second highest in Brazil.

The United States produced 93 million tonnes of soya beans from 31 million hectares.

This was 9.4% more than Brazil produced from 28 million hectares.

Calculate the difference in the yield per hectare of soya beans from these two countries.

(3)

Answer .....

(b) Soya beans can be genetically modified to form transgenic plants.

A study of the nutritional content of soya beans from non-transgenic soya bean plants and from transgenic soya beans plants was carried out in two regions of Brazil.

The regions were Ponta Grossa and Londrina.

Tables 1 and 2 show the results of this study.

Table 1

Type of plant	Region	Mean mineral content / mg per 100 g dried soya beans		
		Iron	Copper	Manganese
Non-transgenic	Ponta Grossa	3.34	0.76	1.38
Transgenic	Ponta Grossa	3.44	0.86	1.40
Non-transgenic	Londrina	4.59	1.35	2.20
Transgenic	Londrina	4.15	1.25	2.02

Table 2

Type of plant	Region	Mean organic content / mg per 100 g dried soya beans		
		Protein	Lipid	Carbohydrate
Non-transgenic	Ponta Grossa	38.61	21.09	23.88
Transgenic	Ponta Grossa	38.80	21.19	23.41
Non-transgenic	Londrina	41.68	18.56	25.74
Transgenic	Londrina	40.62	19.87	25.26

*(i) Analyse the data to assess the nutritional content of soya beans from transgenic and from non-transgenic soya bean plants grown in these two regions.

(6)

(ii) The soil in Londrina is more fertile than the soil in Ponta Grossa. Londrina has higher temperatures and rainfall during the growing season.

Explain the differences in the nutritional content of soya beans grown in these two regions.

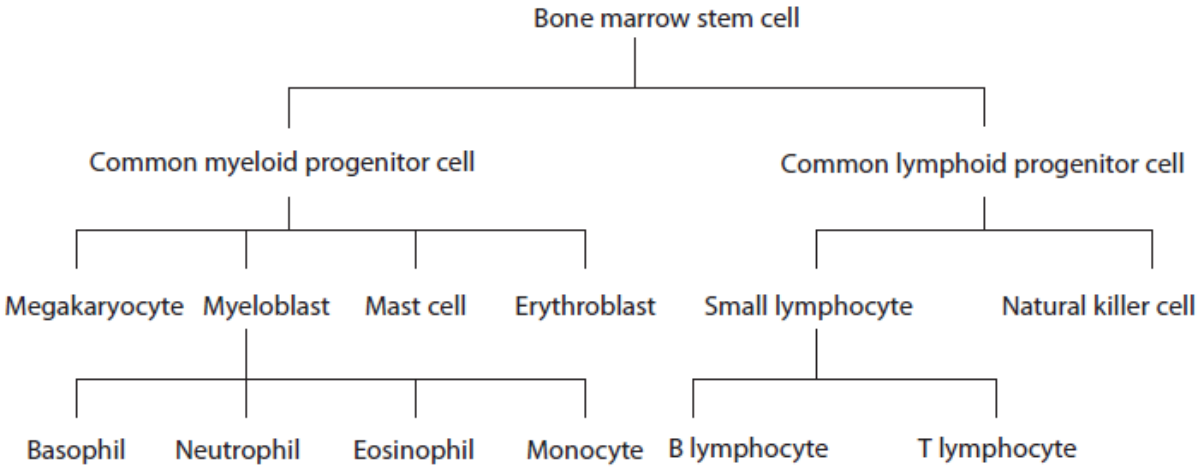
(5)

(iii) Explain why this study also analysed the types of fatty acid found in soya beans from transgenic plants and from non-transgenic plants.

(2)

4

The diagram shows some stages in the production of blood cells from bone marrow stem cells.



Explain how a bone marrow stem cell differentiates into either a common myeloid progenitor cell or a common lymphoid progenitor cell.

(4)

5

(b) Prothrombin is involved in the blood clotting process.

The *F*2 gene codes for the synthesis of prothrombin.

This gene is located from base pair 46 719 191 to base pair 46 739 504 on chromosome 11.

Determine the number of codons in this gene.

(1)

Answer .....

(c) A mutation of the *F*2 gene causes thrombophilia, a condition that results in the production of excess prothrombin.

In this gene mutation, guanine is replaced with adenine.

(i) Name this type of mutation.

(1)

.....

(ii) People without this mutation have a 1 in 1000 risk of producing a blood clot in an artery.

The mutation increases this risk by 20 times.

State the probability of producing a blood clot for people with this mutation.

(1)

.....

(d) A genetic test can be used to find out if a person has thrombophilia.

The test involves using a restriction endonuclease to obtain genetic material from white blood cells.

This genetic material is then used in the polymerase chain reaction (PCR).

(i) State the role of a restriction endonuclease.

(1)

.....

.....

(ii) Describe the process of PCR.

(3)

TOTAL FOR TEST = 40 MARKS