GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Monday 14 October 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI12/01**

Biology

International Advanced Subsidiary/Advanced Level Unit 2: Cells, Development, Biodiversity and Conservation

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

Instructions

- Use **black** ink or **black** ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Show all your working in calculations and include units where appropriate**.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Starch and cellulose are two biological molecules found in cells.

(a) Which type of biological molecule are starch and cellulose?

(1)

☒ **A** phospholipid

☒ **B** polypeptide

☒ **C** polysaccharide

☒ **D** triglyceride

(b) Which structure stores starch in a plant cell?

(1)

☒ **A** amyloplast

☒ **B** mitochondrion

☒ **C** tonoplast

☒ **D** vacuole

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(c) Compare and contrast the structure of a cellulose molecule and a starch molecule.

(3)

(Total for Question 1 = 5 marks)

2 Egg cells vary in size.

(a) The table shows the size of egg cells from three species of animal.

Species	Diameter of egg cell / μm
Orb weaver spider	10
Human	150
Blue poison dart frog	1600

(i) Which of the following shows the diameter, in standard form, of the egg cell of a blue poison dart frog?

(1)

☒ **A** 1.6×10^{-2} μm

☒ **B** 1.6×10^{2} μm

☒ **C** 1.6×10^{-3} μm

☒ **D** 1.6×10^{3} μm

(ii) The egg cells of humans and blue poison dart frogs are approximately spherical.

The volume of a sphere (V) is calculated using the formula

$$V = \frac{4}{3}\pi r^3$$

The volume of the human egg cell is 1.8×10^{6} μm^3.

Calculate how many times larger the volume of the blue poison dart frog egg cell is than the volume of a human egg cell.

Give your answer to two significant figures.

(3)

Answer .....

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(b) An egg cell and a skin cell were removed from a female human.

Both cells contained a nucleus.

The skin cell contained 46 chromosomes.

Explain the differences between the genetic material from these two cells.

(4)

(Total for Question 2 = 8 marks)

3 All living organisms are made of cells.

Eukaryotic cells and prokaryotic cells have some features in common and some differences.

(a) (i) Which cells have a cell wall?

(1)

- ☒ **A** plant cells only
- ☒ **B** animal cells and prokaryotic cells
- ☒ **C** plant cells and prokaryotic cells
- ☒ **D** animal cells, plant cells and prokaryotic cells

(ii) Eukaryotic cells contain a nucleus.

Draw a labelled diagram of a nucleus, as seen using an electron microscope.

(4)

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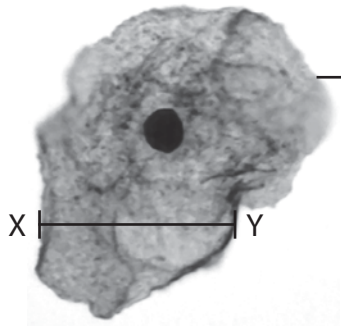
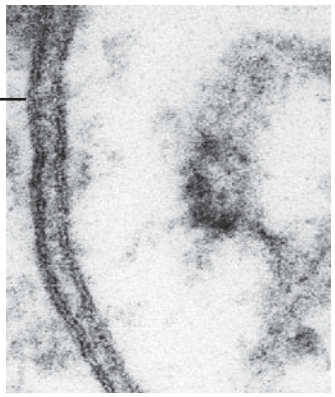
(b) The photographs show a cell as seen using a light microscope and part of two cells using an electron microscope.

The bilayer structure of the cell surface membrane can be seen only with an electron microscope.



(Source: © Komsan Loonprom/Shutterstock)

Cell seen using a light microscope



(Source: © Dennis Kunkel Microscopy /Science Photo Library)

Part of cells seen using an electron microscope

(i) Explain why the bilayer structure of the cell surface membrane could not be seen using a light microscope.

(2)

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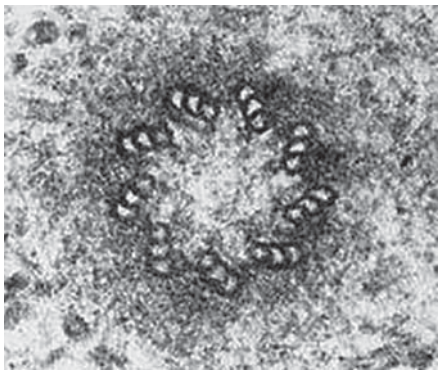
(ii) The light microscope magnified the cell 200 times.
Calculate the actual width of this cell by measuring the line XY.

Give your answer in µm.

(3)

Answer ..... µm

(iii) The photograph shows an organelle that can be found in a eukaryotic cell, as seen using an electron microscope.



Describe the function of this organelle.

(2)

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(Total for Question 3 = 12 marks)

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4 The scientist Carl Woese proposed the three-domain system of classification.

The photograph shows *Haemanthus albiflos*, a flowering plant native to South Africa.



(Source: © COULANGES/Shutterstock)

(a) (i) Which of the following is the domain for this plant?

(1)

- ☒ **A** Archaea
- ☒ **B** Bacteria
- ☒ **C** Eukarya
- ☒ **D** Prokaryota

(ii) Describe the evidence that Carl Woese used to support his system of classification.

(2)

(b) A pollen grain can germinate on the stigma of a flower.

After germination, a pollen tube grows through the style.

Explain the function of a pollen tube in the fertilisation of flowering plants.

(3)

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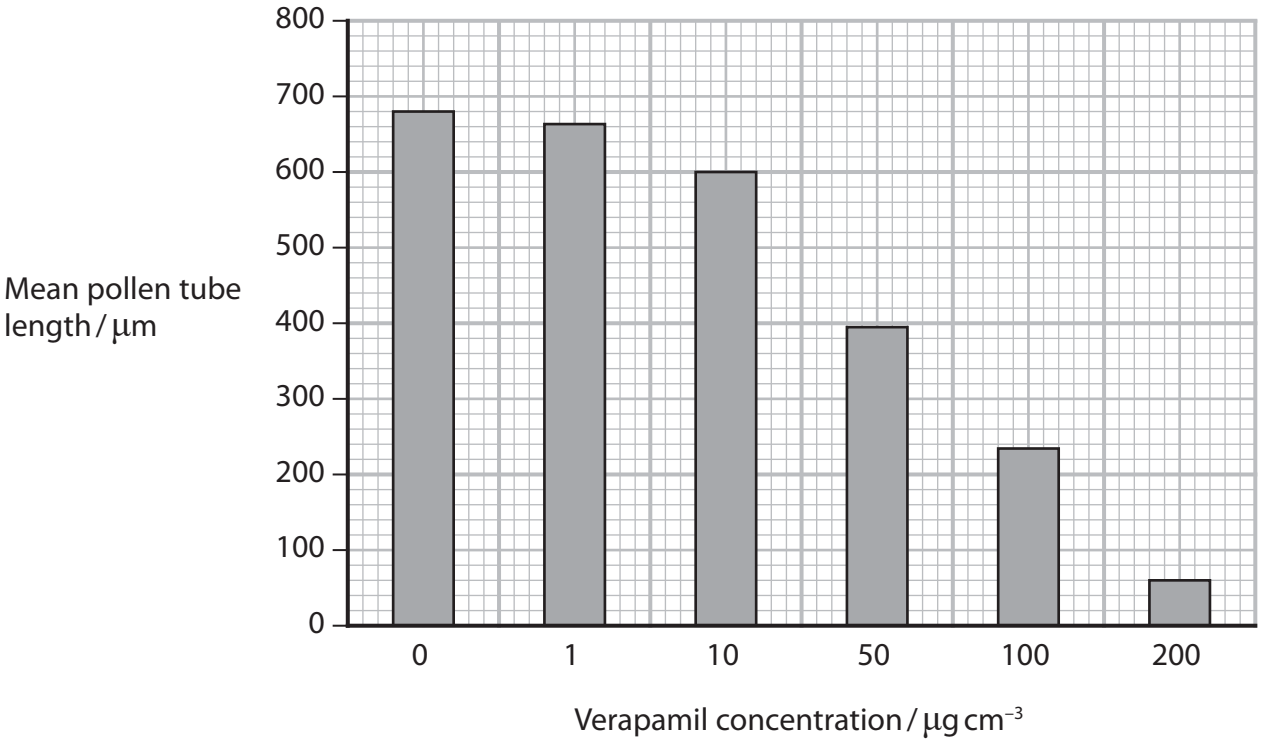
(c) Verapamil is a substance that inhibits the uptake of calcium ions by the pollen tube.

An investigation was carried out to study the effect of Verapamil on the growth of pollen tubes.

Each pollen sample was exposed to a different concentration of Verapamil solution.

The lengths of the pollen tubes in each sample were measured after one hour.

The graph shows the mean length of the pollen tubes after one hour in each concentration of Verapamil.



(i) Determine the effect of Verapamil concentration on the growth of pollen tubes.

(2)

(ii) Explain why Verapamil can reduce the strength of cell walls.

(3)

(Total for Question 4 = 11 marks)

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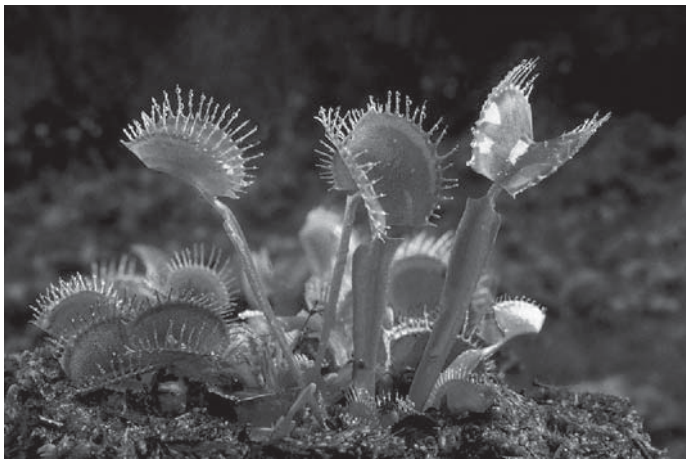
5 The photograph shows a Venus fly trap (*Dionaea muscipula*), a plant native to North and South Carolina in the United States.



This plant is found in nitrogen and phosphorus poor environments, such as a bog. The plant catches and digests insects and spiders and absorbs compounds containing nitrogen.

(a) Explain why the Venus fly trap needs compounds containing nitrogen.

(2)

(b) The Venus fly trap secretes extracellular enzymes that digest the insects and spiders it catches.

Describe the role of the Golgi apparatus in forming these extracellular enzymes.

(2)

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(c) Extracts from Venus fly trap plants are used in some alternative medicines as a treatment for HIV and some cancers.

Complete the diagram to show how an extract could be tested as part of the initial stages of a drug trial.

(3)

Pre-clinical stage

Tested on .....

↓

Phase 1

Tested on healthy volunteers

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↓

Phase 2

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Phase 3

Tested on 1000 to 3000 volunteer patients with the disease

(Total for Question 5 = 7 marks)

6 The photograph shows a strawberry poison dart frog.



(Source: © Dirk Ercken. Shutterstock (PAL))

The strawberry poison dart frog is found in parts of Nicaragua, Costa Rica and Panama only. This frog has several features that are adaptations to its environment.

Three of these features are:

- bright red skin with black spots
- production of a powerful poison that can cause paralysis
- adhesive discs at the end of each toe.

(a) Which of the following is a term used to describe the fact that this frog is found only in these countries?

(1)

☒ **A** diversity

☒ **B** endemic

☒ **C** polygenic

☒ **D** specific

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(b) Complete the table to show the type of adaptations shown by this frog.

(3)

Feature	Type of adaptation
bright red skin with black spots	
production of poison	
adhesive discs on toes	

(c) Suggest the advantages for the frog of these features.

(2)

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(d) Suggest how natural selection could have given rise to frogs that can produce poison.

(4)

(Total for Question 6 = 10 marks)

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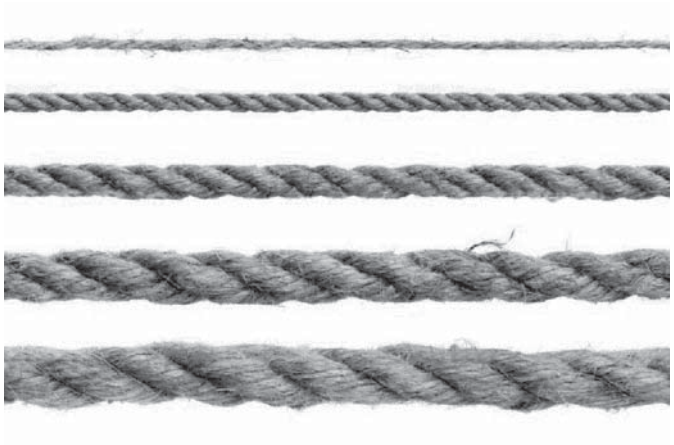
7 Some plant fibres have a high tensile strength.

The photograph shows ropes made using fibres from the stems and leaves of hemp plants.



Sclerenchyma fibres and xylem vessels are found in plant fibres.

(a) Both sclerenchyma fibres and xylem vessels contain lignin.

(i) How many of the following statements are correct?

- Lignin adds strength to the cell membranes.
- Lignin gives waterproofing properties.
- Lignin can form spiral shapes.

(1)

☒ **A** none

☒ **B** one

☒ **C** two

☒ **D** three

(ii) Give **one** similarity, other than the presence of lignin, and **one** difference in the structures of sclerenchyma fibres and xylem vessels.

(2)

Similarity .....

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Difference .....

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(b) Scientists have suggested that plant-based plastics should be used instead of oil-based plastics.

Hemp has been used to make some of these plant-based plastics.

Explain why hemp fibres are a sustainable resource.

(2)

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(c) Biofuels, produced from crop plants, are a sustainable resource.

Biofuels include bioethanol and biodiesel.

Bioethanol is produced from hemp and from sugar beet. Biodiesel is produced from rapeseed oil and from soybean oil.

(i) The table shows information about the global production of bioethanol.

Year	Global production of bioethanol $\times 10^6$ dm^3
2000	17 000
2011	84 600

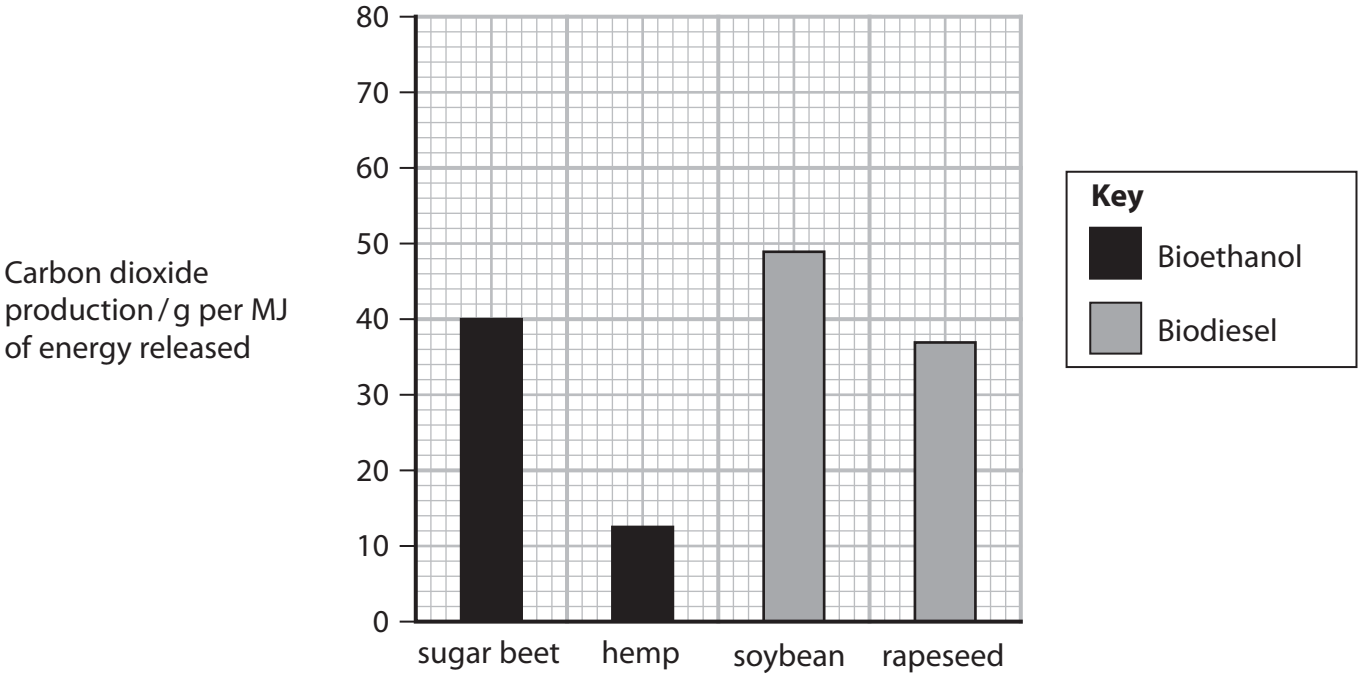
Determine what the global bioethanol production will be in 2020.

Assume the mean rate of increase stays constant.

(3)

Answer .....

*(ii) The use of biofuels produces carbon dioxide. The graph shows the production of carbon dioxide using biofuels from four crop plants.



The table gives information about the level of water, fertilisers and pesticides needed for crop plants to grow.

Crop plant	Level of resources used in production of biofuels		
	Water	Fertilisers	Pesticides
Hemp	Medium to low	Low	Low
Rapeseed	High	Medium	Medium
Soybean	High	Low to medium	Medium
Sugar beet	Medium to low	High	Medium

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Explain the advantages and disadvantages of using these crop plants as a sustainable resource to produce biofuels.

Use the information in the question to support your answer.

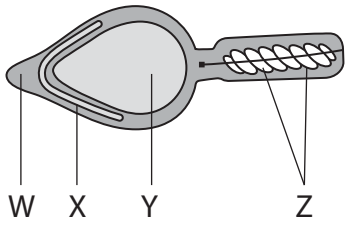
(6)

(Total for Question 7 = 14 marks)

8 The phenotype of a rabbit is affected by its genotype.

Rabbit sperm cells contain genetic information that will become part of the genotype of the offspring.

The diagram shows part of a rabbit sperm cell.



(a) Which labelled structure contains the genetic information used in the synthesis of acrosomal enzymes?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(b) A fertilised rabbit egg cell will divide by mitosis to form a solid ball of genetically identical cells.

Name this solid ball of cells.

(1)

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(c) The genetically identical cells in a developing rabbit embryo will continue to divide by mitosis.

Some of the cells produced can undergo epigenetic modification as they develop into specialised cells.

(i) Epigenetic modification can alter the activation of certain genes.

Describe **one** form of epigenetic modification that could occur in the rabbit cells.

(2)

(ii) Explain how cells in the rabbit embryo become specialised after epigenetic modification.

(3)

*(d) The table shows information about three types of rabbit.

Type of rabbit	Black 	Himalayan 	Albino 
Colour of fur	Solid black all over	White fur with black ears, nose, paws and tail	White all over
Allele combination(s)	CC, Cc^{ch}, Cc^{a}	$c^{h}c^{h}$, $c^{h}c^{a}$	$c^{a}c^{a}$

Enzymes produced by the rabbits control the production of pigments in the fur.

One type of rabbit produces an enzyme that is inactive at the core body temperature of the rabbit.

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Discuss how genes and the environment interact to produce the fur colour of these three types of rabbit.

Use the information in the question to support your answer.

(6)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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