

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 2: CELLS, VIRUSES AND REPRODUCTION OF LIVING THINGS
SEXUAL REPRODUCTION IN PLANTS

SCORE

/30

PERCENTAGE

%

STEMUP

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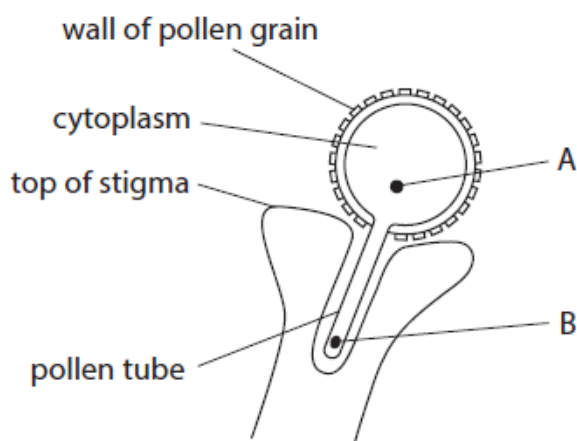
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Q1.

(i) The diagram shows a pollen grain that has begun to germinate after landing on the surface of the stigma of a flower.



Identify the structures labelled A and B.

(2)

A

B

(ii) Describe the process of double fertilisation in flowering plants.

(3)

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(Total for question = 5 marks)

Q2.

In flowering plants, pollen grains grow pollen tubes that are involved in fertilisation, producing a zygote and endosperm.

A scientist investigated the effects of chemical A and chemical B on pollen tube growth.

Chemical A prevents transcription.

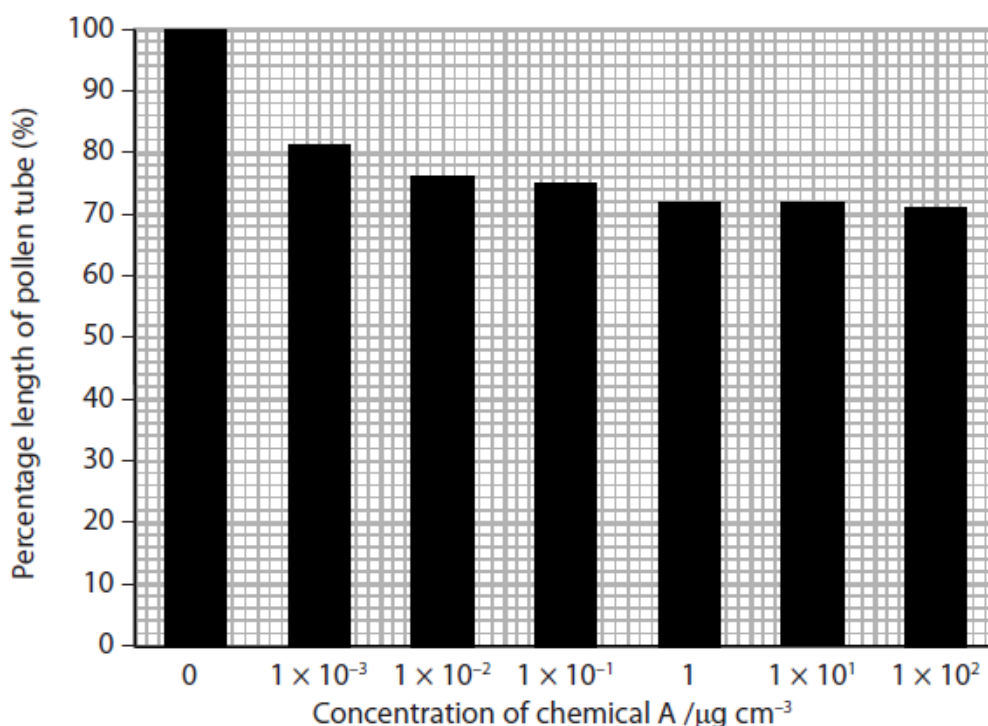
Chemical B prevents translation.

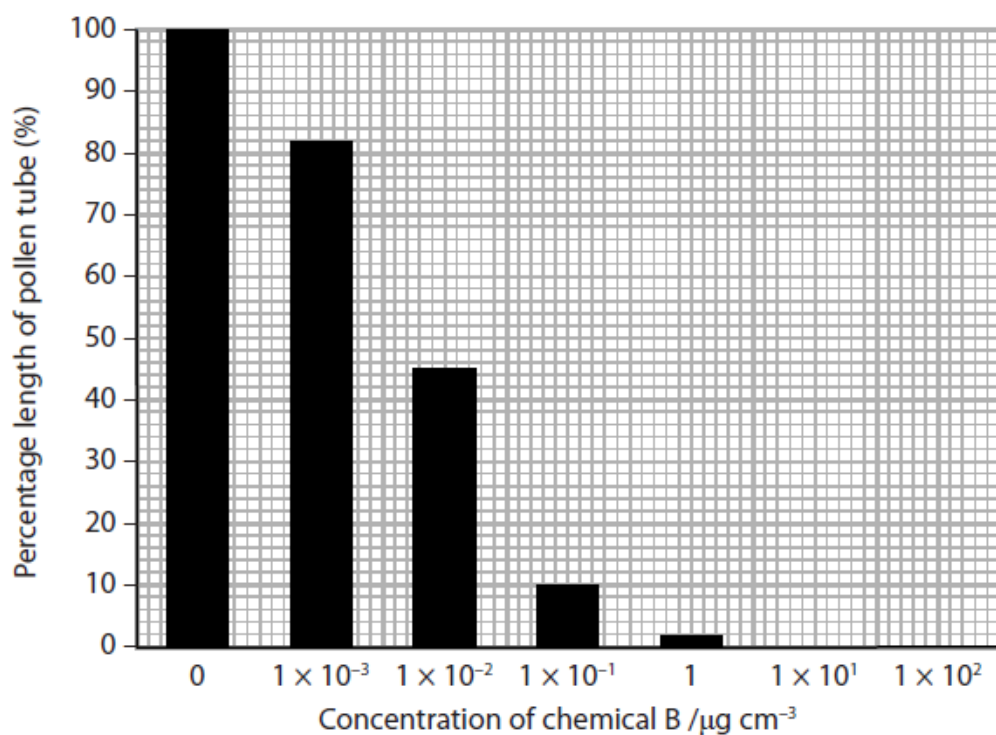
Pollen grains were treated with different concentrations of these two chemicals.

The lengths of the pollen tubes they produced were compared with a control group of pollen grains.

The lengths of the pollen tubes were measured and expressed as a percentage of the control group.

The results are shown in the graphs.





(i) The mean length of the pollen tubes in the control group was 7.5 mm.

Calculate the mean length of the pollen tubes after adding $0.010 \mu\text{g cm}^{-3}$ of chemical A.

(2)

Answer

(ii) Analyse the data to comment on the effects of chemical A and chemical B on the roles of transcription and translation in pollen tube growth.

(4)

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total for question = 6 marks)

Q3.

Fritillaria delavayi is a small plant (height 7 cm), that grows on rocky slopes on mountains in China.

The image shows *Fritillaria delavayi*.



For at least 2 000 years, this plant has been collected and used in Chinese medicine. It is not known to be eaten by animals.

In less accessible regions, where few humans go, the plants are bright green with bright yellow flowers.

In locations where bulbs are collected in high numbers, most plants have greyish-brown leaves and flowers.

Scientists believe that the greyish-brown plants are the same species as the brightly-coloured plants.

(i) Describe how scientists can use gel electrophoresis to show that these plants belong to the same species.

(4)

(ii) Explain why the features of the brightly-coloured plants enable them to grow successfully in the areas where they are not collected by humans.

(2)

(Total for question = 6 marks)

Q4.

In flowering plants, pollen grains grow pollen tubes that are involved in fertilisation, producing a zygote and endosperm.

(i) Which row of the table shows the correct description for these nuclei?

(1)

	Zygote nucleus	Endosperm nucleus	Pollen tube nucleus
☐ A	diploid	diploid	haploid
☐ B	diploid	triploid	haploid
☐ C	diploid	triploid	diploid
☐ D	haploid	triploid	diploid

The graph shows the DNA content of a cell during the production of a pollen grain.

The graph illustrates the changes in the relative mass of DNA in a cell during the cell cycle. The y-axis represents the 'Relative mass of DNA in a cell' with a scale from 0 to 4. The x-axis represents 'Time'. The DNA mass starts at a constant level of 2. It then undergoes a rapid increase to 4, which remains constant for a period. This is followed by a sharp decrease back to 2. The mass then fluctuates, dropping to 1 and rising back to 2 several times, before finally settling back at 1.

☐ **A** meiosis, mitosis, mitosis

☐ **B** meiosis, mitosis, meiosis

☐ **C** mitosis, meiosis, meiosis

☐ **D** mitosis, mitosis, meiosis

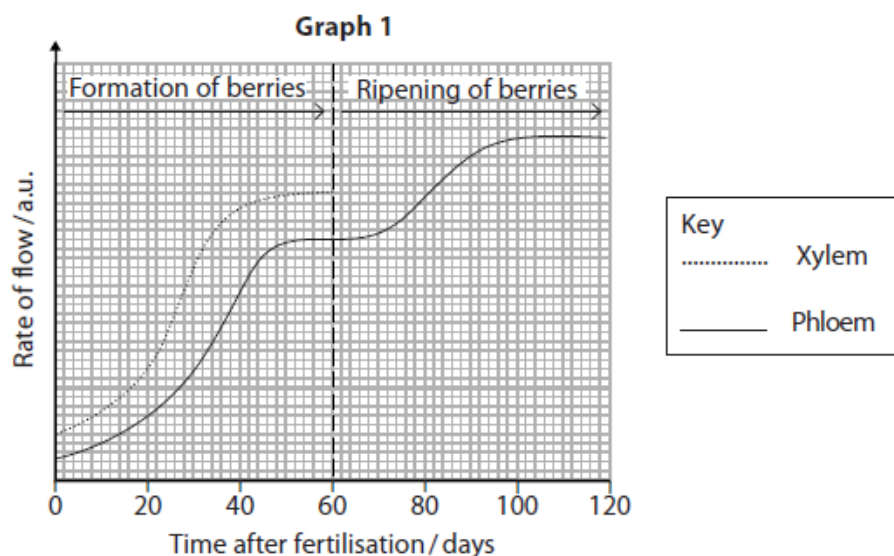
(Total for question = 2 marks)

Xylem and phloem are involved in transport in plants.

* Double fertilisation in some plants leads to the development of fruits, such as berries.

In an investigation, the rate of flow in xylem during the formation of berries was measured. The rate of flow in the phloem during the formation and ripening of the berries was also measured.

The results are shown in graph 1.

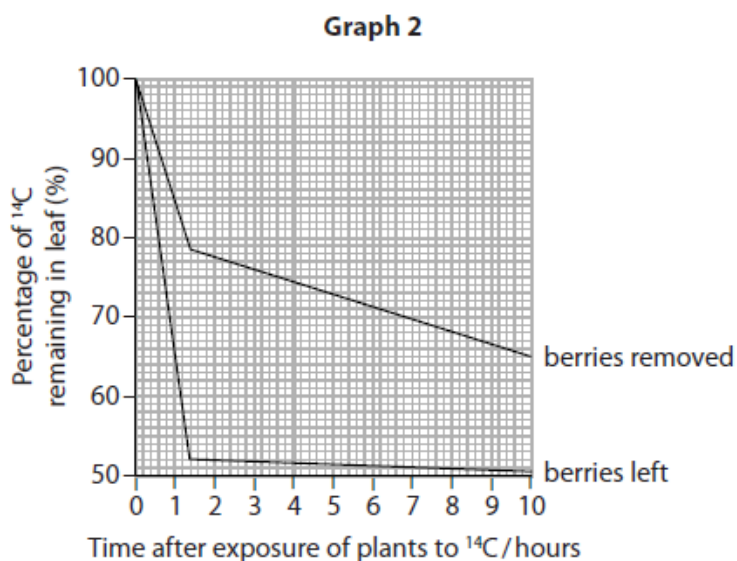


In a second investigation, two plants with berries were exposed to radioactive carbon dioxide (^{14}C).

After exposure to ^{14}C , the berries were removed from one plant and left on the second plant.

The percentage of ^{14}C remaining in the leaves of each plant was determined during the next 10 hours.

The results are shown in graph 2.



Analyse the data to explain the role of double fertilisation, xylem and phloem in the development of the berries.

(6)

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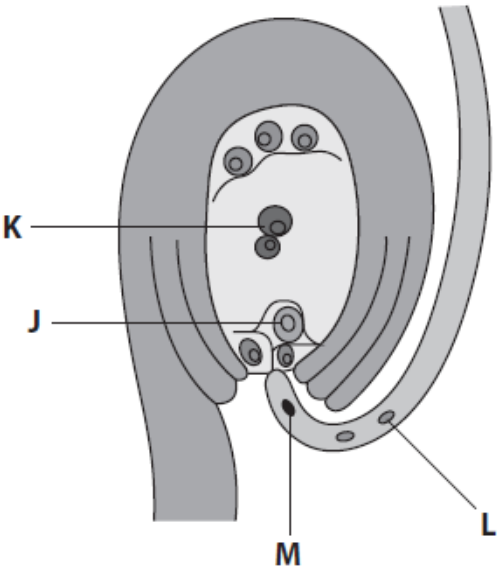
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(Total for question = 6 marks)

Q6.

The diagram shows a pollen tube entering the embryo sac of a flowering plant.



Complete the table to give the name of each labelled structure and the number of sets of chromosomes that each structure contains.

(4)

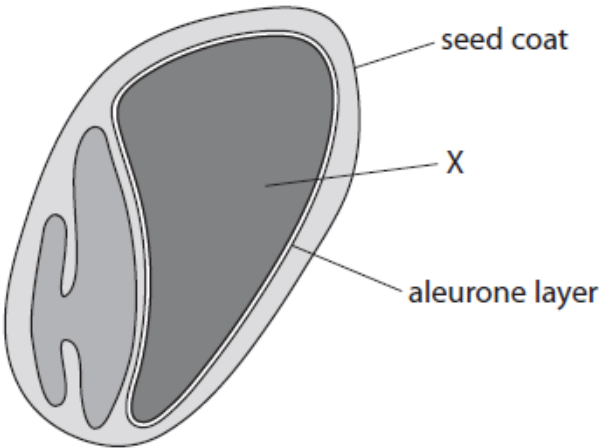
Structure	Name of structure	Number of sets of chromosomes
J		
K		
L		
M		

(Total for question = 4 marks)

Q7.

Gibberellin stimulates cells in the aleurone layer of cereal grains, such as barley, to produce the enzyme amylase.

The diagram shows the location of the aleurone layer in a barley grain.



The part labelled X contains triploid cells.

Name the part labelled X.

(1)

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	A: generative nucleus (1) B: (pollen) tube nucleus (1)	If 2 suggestions provided, 0 marks	Grad (2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation including three of the following • {one male nucleus / one male gamete} fuses with the two polar nuclei • to form a {triploid / $3n$} nucleus (1) • {one male nucleus / one male gamete} fuses with the {egg cell / female gamete / ovum} • to form the {diploid / $2n$} zygote (1)	Do not allow polar bodies Do not allow fertilises Accept triploid endosperm nucleus Accept fertilises Do not accept embryo	Exp (3)

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	- reading from graph at 1×10^{-2} - reading multiplied by 7.5 and divided by 100	<u>Example of calculation:</u> 76 % $76 \div 100 \times 7.5 \text{ mm} = \underline{5.7 \text{ mm}}$ Accept 5700 μm TE for wrong reading from graph A Correct answer gains full marks 5.7 with no units = maximum 1 mark	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to four of the following: {chemical A / stopping transcription} has {less effect / smaller reduction} on pollen tube growth (1) - growth levels off when chemical A increases and growth {falls steeply / drops to zero} when chemical B increases (1) - mRNA is already present (1) (pollen tube) growth requires production of new proteins / enzymes (1)	Accept converse for chemical B / stopping translation Accept correct mathematical comparison e.g. overall chemical A causes a 29% drop and chemical B causes a 100 % drop Accept transcription occurred before chemical A added Accept pollen tube cannot grow without synthesis of new proteins	(4)

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that includes four of the following: • obtain DNA (from the two types of plants) (1) • {use of restriction enzymes to cut DNA into fragments / use of PCR to amplify DNA} (1) • {DNA / fragments} (loaded) on (agarose) gel with {current passed through / voltage or potential difference applied} (1) • fragments of DNA are separated (1) • {same / similar} (banding) pattern suggests they are the same species (1)	Accept movement of (negatively charged) DNA moves to positive electrode Accept description / diagram of banding pattern Accept shorter fragments travel further Accept converse	Exp (4)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that includes two of the following: • (if leaf is green it contains) chlorophyll / photosynthetic pigments (1) • so more {light / more wavelengths of light} absorbed for photosynthesis (1) • so more glucose produced for growth (1) OR • (if flower is brightly coloured) it attracts {pollinators / insects} (1) • so (more likely to) reproduce successfully (1) • to produce seeds / pass trait on (1)	Accept more light / wavelengths of light leads to higher rate of photosynthesis Accept more GALP / TP / GP for growth Accept so increased genetic variation (as less self-pollination) Accept asexual reproduction (through bulb) still possible if pollination does not occur	Exp (2)

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	The only correct answer is B (diploid , triploid, haploid) A is not correct because the endosperm nucleus is not diploid but triploid C is not correct because the pollen tube nucleus is not diploid but haploid D is not correct because the zygote nucleus is not haploid but diploid and the pollen tube nucleus is not diploid but haploid		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	The only correct answer is A (meiosis, mitosis, mitosis) B is not correct because the third division is not meiosis but mitosis as the DNA mass remains the same C is not correct because the first division is not mitosis as the DNA mass halves and the second and third divisions are both mitosis as the DNA mass remains the same and does not halve D is not correct because the first nuclear division halves the DNA mass and the third nuclear division does not halve the DNA mass so is not meiosis		(1)

Q5.

Question Number	Indicative content
*	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content: • male gamete fertilise female gamete to produce embryo • one male gamete fuses with {both polar nuclei / (diploid) endosperm nucleus} to form a triploid endosperm nucleus • endosperm is a store of {starch / protein / oils} • ovules will become the seeds inside the berries • xylem transports the water needed for berry formation shown in graph 1 • xylem transports the water needed for hydrolysis of food stores • xylem transports mineral ions for berry formation • phloem transports the sucrose needed for berry formation and ripening in graph 2 • more sucrose is transported from the leaves when berries are present in graph 2 • ^{14}C incorporated into glucose during photosynthesis • glucose converted into sucrose for transport in the phloem

Level 0	Marks	No awardable content
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context. 2 or 3 comments made which may include description of graphs and / or explanations
Level 2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure. 4 of 5 comments that include explanations with reference to at least two components
Level 3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. 6 or 7 comments that include explanations with reference to all three components

Q6.

Question Number	Answer				Additional Guidance	Mark
	Structure	Name of structure	Number of sets of chromosomes		NB Any two correct cells = 1 mark	(4)
	J	egg cell / female gamete	one / haploid / n	(1)	ACCEPT ovum / ova	
	K	polar nucleus / nucleus that forms the endosperm nucleus	one / haploid / n	(1)	ACCEPT pleural	
	L	male gamete	one / haploid / n	(1)	ACCEPT male / sperm nucleus pleurals	
	M	(pollen) tube nucleus	one / haploid / n	(1)	DO NOT ACCEPT generative nucleus	

Q7.

Question Number	Answer	Additional guidance	Mark
	endosperm		(1)