Neap

Trial Examination 2020

VCE Biology Units 1&2

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing: 2 hours 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	40	40	40
B	10	10	80
			Total 120

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 32 pages

Answer sheet for multiple-choice questions

Instructions

Please ensure that you write **your name** and your **teacher's name** in the space provided on this booklet and in the space provided on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

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SECTION A – MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1

Which one of the following correctly describes a type of living cell, the organelles found within its cell cytoplasm and the function of its organelles?

A. Some specialised types of white blood cells contain many lysosomes containing enzymes to help break down ingested bacteria.

B. Pancreatic cells that produce the hormone insulin contain extensive smooth endoplasmic reticulum to transport the protein hormone.

C. Bone cells contain no nuclei as their main function is to provide strength and support, so they do not need cell regulation and control.

D. Salivary gland cells contain many ribosomes to synthesise the amylase enzyme protein, but require no Golgi bodies as the enzyme passes directly into the mouth.

Question 2

Depending on the size and shape of cells, their surface area to volume ratio the for exchange of substances between the cell cytoplasm and external environment can vary considerably.

Examine the following four cell types and, using the information given and your knowledge, select which cell type will be most efficient for exchange.

	Cell type	Shape	Size
A.	plant leaf cell	brick-like	0.1–0.2 mm × 0.01–0.05 mm
B.	human cheek cell	cuboidal	58 × 57 microns
C.	*Elodea* water plant cell	box-like	50 × 0.025 microns
D.	mature red blood cell	biconcave disc	7–8 microns diameter

Question 3

The plasma membrane, containing both lipids and proteins and surrounding the cell cytoplasm,

A. is only found in eukaryotic cells that contain membrane-bound organelles.

B. is essential in all living cells as a controlling boundary.

C. has a fixed structure that does not change during the life of a cell.

D. contains cholesterol, which makes the membrane less stable.

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Question 4

Four major processes of the transport of soluble substances across plasma membranes are essential for efficient functioning in the human digestive system.

These include

A. absorption of amino acids from a lower concentration in the gut to a higher concentration in the blood by diffusion.

B. movement of glucose from a higher concentration in the gut to a lower concentration in the blood using energy by the process of facilitated diffusion.

C. absorption of mineral salt ions down the concentration gradient in the gut into the blood by active transport.

D. movement of water from a higher water concentration in the gut to a lower water concentration in the blood by the passive process of osmosis.

Question 5

Internal compartmentalisation in a cell

A. enables the cell to carry out different metabolic activities at the same time under different conditions.

B. comprises all the closed parts within the cytosol of the cell surrounded by a protein layer membrane.

C. is important for the efficient functioning of both prokaryotic and eukaryotic cells.

D. provides specific micro-environments so that different biological processes can all occur in the same environment.

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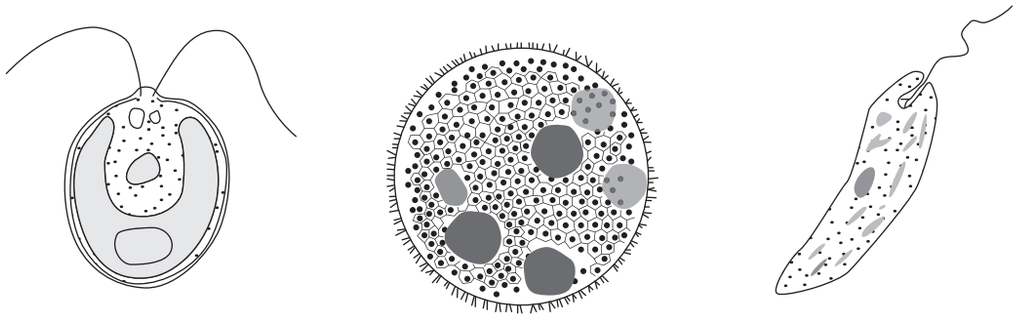
Use the following information to answer Questions 6–9.

The diagram below shows a number of organisms.



Chlamydomonas *Volvox* *Euglena*

Chlamydomonas is a unicellular organism that lives in freshwater and saltwater and freely moves around using its two anterior whip-like flagella. It has a large central cup-shaped chloroplast with a red eyespot for photosensitivity. It has a cell wall made of glycoprotein, not cellulose. In freshwater ecosystems, *Chlamydomonas* and other green unicellular and simple multicellular organisms play an important role. Some of these other organisms are also shown in the diagram above.

Question 6

From your knowledge and the information given, which one of the following statements is correct?

A. As they have a chloroplast for photosynthesis, *Chlamydomonas* cells would not have mitochondria, as usable cellular energy would be obtained directly from the sun.

B. *Chlamydomonas* would spend daylight hours in deeper water to avoid the warmer surface water heated up by the sun.

C. The cells of *Chlamydomonas* are well adapted for their functioning as they have eyespots to detect light used in an important cell process.

D. The *Chlamydomonas* would be classified as a prokaryote as no nuclei are seen in their living cells.

Question 7

The presence of eyespots in *Chlamydomonas* indicates that they

A. can carry out responses according to the stimulus-response model.

B. can carry out coordinated regulated responses.

C. have homeostatic regulation, as occurs in humans.

D. use their eyespots as effector structures.

Question 8

Chlamydomonas, *Volvox* and *Euglena* are all important organisms filling similar roles in freshwater ecosystems.

The relationship between these three types of organisms is called

A. competition.

B. commensalism.

C. cooperation.

D. collaboration.

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Question 9

Grouped together in their role in freshwater ecosystems, *Chlamydomonas*, *Volvox* and *Euglena* could be called

A. zooplankton.

B. the first trophic level.

C. second-order producers.

D. decomposers.

Question 10

Aerobic cellular respiration is more efficient than anaerobic cellular respiration as it

A. involves the incomplete breakdown of glucose into water and carbon dioxide.

B. produces waste products: lactic acid in animals and ethanol in plants.

C. generates more energy stored in ATP molecules per glucose molecule than in anaerobic respiration.

D. takes place only during the daytime in all living cells.

Question 11

Mosses, ferns, algae, conifers, flowering plants and cyanobacteria can all carry out photosynthesis.

All living cells that carry out photosynthesis must contain

A. mitochondria.

B. chloroplasts.

C. nucleoli.

D. chlorophyll.

Question 12

The internal environment of the body includes

A. body cells.

B. blood vessels.

C. body fluids.

D. lung air sacs.

Question 13

Four students were chosen to visit Antarctica on a special research trip. They were advised about the cold temperature, especially the windchill factor.

Which one of the following students' bodies would be best prepared to increase the heat generation needed in these very cold temperatures?

A. Tom, who has increased vasodilation in his fingers and toes

B. Toby, whose muscle cells have increased metabolic rate

C. Lou, whose body hairs have fluffed up to improve insulation

D. Shawn, who wore four layers of fine wool clothing for warmth

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Use the following information to answer Questions 14–17.

Sea otters are marine mammals found along the coasts of the Pacific Ocean in North America and Asia. They have webbed feet, water-repellent fur, and nostrils and ears that close in the water. Sea otters spend most of their time in the water and are frequently observed lying on their backs in the sea, cracking their food with a stone stored in a pocket under their arm. They have no blubber but are kept warm by their thick fur and by wrapping themselves in the large brown seaweed kelp as they sleep in the water. They feed on fish and marine invertebrates including crabs, sea urchins, mussels and snails.

Question 14

Sea otters have many specific adaptations to help them survive in their marine environment.

Behavioural adaptations include

A. the pocket under the arm for stone storage.

B. nostrils and ears that can be closed underwater.

C. wrapping their bodies in kelp during sleep.

D. thick, water-repellent fur for body warmth.

Question 15

A sea otter's favourite food is sea urchins. The otter can crack open the sea urchin by lying on its back and using a rock to destroy the sea urchin's spines, gaining access to the meat inside. Other animals cannot get to the meat because of the sea urchin's long sharp spines.

The relationship between the sea otter and the sea urchin is correctly called

A. host/parasite.

B. competitor/benefiter.

C. eater/food.

D. predator/prey.

Question 16

Sea otter numbers were on a drastic decline in the early 1900s due to humans hunting them for their furs, oil spills and other water pollutants. If all or most of the sea otters disappeared, the sea urchins would be able to reproduce unchecked. Sea urchins feed on kelp stems, which results in the death of the kelp plants.

The result of having fewer sea otters could be that

A. the kelp marine forests regenerate and flourish.

B. all the fish and invertebrates populations in the kelp ecosystem increase.

C. the kelp ecosystem totally collapses.

D. a flourishing reef of kelp, sea urchins and other invertebrates develops.

Question 17

Sea otters can have an extremely large impact on kelp ecosystems, disproportionate relative to their population size.

Because of this, they are referred to as a

A. dominant species.

B. keystone species.

C. flagship species.

D. foundation species.

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Use the following information to answer Questions 18–20.

A student wrote the following statement:

If yeast is mixed with a glucose solution and warmed to 25°C, then the rate of breakdown of the glucose by anaerobic respiration will be faster than at 15°C.

The student then set up ten test tubes with 1 g of dried yeast in each tube. To five of the test tubes, he added 100 mL of 10% glucose solution at 15°C; 100 mL of the same glucose solution warmed to 25°C was added to the other five tubes. A stopper was immediately placed in each tube and a syringe attached to measure the volume of carbon dioxide given off every twenty seconds. The results were graphed and compared.

Question 18

In scientific methodology, the initial statement written by the student is called a

A. suggestion.

B. hypothesis.

C. prediction.

D. theory.

Question 19

The use of the same amount of yeast, the same volume and concentration of glucose solution and the same method of measurement for the gas are collectively called

A. experimental variables.

B. constant variables.

C. controlled variables.

D. control groups.

Question 20

The dependent variable in this experiment was the

A. total volume of carbon dioxide measured after five minutes.

B. amount of yeast added to each tube.

C. temperature of the glucose solution added to each tube.

D. volume of carbon dioxide being given off every twenty seconds.

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Use the following information to answer Questions 21–22.

The sequence of events that take place from one cell division to another is called the cell cycle. Use your knowledge of the cell cycle to answer the following questions.

Question 21

This sequence of events is called a cycle because

A. the stages repeat each time the cell divides.

B. the cycle takes place in phases.

C. the cycle is a continuous process.

D. every cell produced will divide again.

Question 22

The longest stage in the cycle is

A. nuclear division, as it involves all four stages of mitosis.

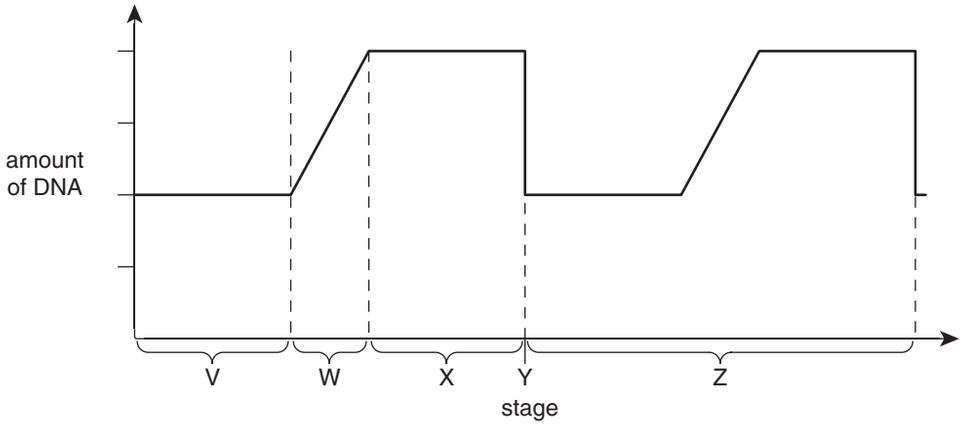
B. the synthesis phase, as exact copies of all the DNA molecules must be formed.

C. the first growth phase, as the new cell needs to produce new proteins and grow.

D. interphase, as the new cell goes through different stages ready for the next division.

Question 23

The following graph shows the changes in the amount of nuclear DNA per cell during the cell cycle. These changes reflect the different phases that occur in the cycle.



Based on the information in the graph, which one of the following statements is correct?

A. Stage W involves cell growth.

B. Stage V is mitosis.

C. The graph shows one cell cycle.

D. Stage Y is cytokinesis.

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Question 24

Asexual reproduction is the only type of reproduction that involves

A. a single parent to produce offspring.

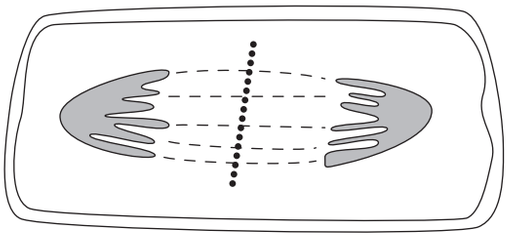
B. the processes of meiosis and mitosis.

C. no fusion of gametes.

D. gametes of one type only.

Question 25

The diagram below shows a cell undergoing mitosis.



Which one of the following conclusions can be drawn about its location and stage of mitosis?

A. This is a plant cell at telophase, as a new cell wall can be seen forming.

B. This is an animal cell at anaphase, as it shows two groups of chromosomes pulling apart.

C. No cell membrane or other organelles can be seen, so this is a bacterial cell at telophase.

D. Only the remnants of spindle fibres can be seen, so this is an animal cell at late anaphase.

Question 26

Various drugs, such as vincristine, are important chemotherapeutic agents in the treatment of some types of cancer. They are called mitotic inhibitors as they disrupt the formation of microtubules in cells, which are needed to move chromosomes around the cell.

Which one of the following contains the two stages of mitosis that would be interrupted by these drugs?

A. interphase and prophase

B. metaphase and anaphase

C. anaphase and telophase

D. prophase and metaphase

Question 27

Daughter cells produced in meiosis contain

A. the same amount of DNA as the parent cell, as DNA doubles during meiosis.

B. double the number of chromosomes, as each parental chromosome consists of two chromatids.

C. chromosomes with the same alleles at each gene locus as the parent cell.

D. one of each parental chromosome with the same gene loci as the original chromosome.

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Question 28

Skin colour in humans depends on the amount of pigment present in their cells and shows a wide range of possible densities, ranging from high to low levels.

This is an example of a human trait that shows continuous variation, in which

A. one main gene controls skin colour.

B. each skin colour gene has only one allele.

C. polygenes on autosomes control skin colour.

D. the resulting skin colours will consist of a few discrete groups.

Question 29

An example of an epigenetic factor that can have an effect on the phenotype of an organism is histone modification. Histones are proteins that DNA wraps around so that the DNA is tightly coiled up and can fit inside the nucleus of the cell. If histones squeeze too tightly, however, the cell cannot 'read' the DNA.

Histone modification can be described as an epigenetic factor, which

A. modifies the expression of genes.

B. alters the sequence of the DNA molecule.

C. cannot be inherited even if it occurs in the gametes.

D. turns genes on permanently.

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Use the following information to answer Questions 30–33.

In 2018, after five years of research by Australian and international scientists, it was announced that the first full sequencing of the koala genome had been completed. The Australian-led team, consisting of scientists from seven different countries, sequenced 3.4 billion base pairs in the DNA of the koala cells. They make up more than 26 000 genes, making it slightly larger than the human genome. Koalas have sixteen large chromosomes per somatic cell and a similar sex-determining chromosome system to humans and most other mammals.

Question 30

The genome of a koala would consist of

A. sixteen chromosomes.

B. eight chromosomes.

C. 1.7 billion base pairs.

D. 26 000 genes.

Question 31

Which one of the following sets of autosomes and chromosomes would a female baby koala inherit from its mother?

A. seven autosomes and one X chromosome

B. seven autosomes and two X chromosomes

C. eight autosomes and one X chromosome

D. fourteen autosomes and two X chromosomes

Question 32

Which one of the following can be drawn from studying the information provided from the Koala and Human Genome Projects?

A. The sequence of base pairs in the DNA would be the same in all members of the koala species, as they have the same gene loci on their chromosomes.

B. Koalas are more complex than humans, as they have a higher number of base pairs in their DNA than humans.

C. Identical human twins would have no differences in their genome, compared to many differences in non-identical twins.

D. The greater number of base pairs in the koala genome results in a higher diploid number.

Question 33

The Koala Genome Project will be helpful in many ways to support the conservation and preservation of koalas in Australia.

How would the project **not** be helpful for the conservation and preservation of koalas?

A. studying the relationship between the koala and other bears

B. providing knowledge about disease susceptibility and resistance in koalas

C. comparing current genetic diversity with koalas collected in the past

D. supplying information on the unusual and highly specialised diet of koalas

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Use the following information to answer Questions 34 and 35.

The X chromosome in humans is significantly longer than the Y chromosome, as it has approximately 1098 genes compared to only 26 genes on the Y chromosome. Sixteen of the genes on the Y chromosome are for cell maintenance; nine are for sperm production and one is for male sexual traits. The single gene determining maleness is called the SRY gene. It is responsible for triggering the activation and regulation of another gene, the Sox9 gene, found on a non-sex chromosome. This Sox9 gene triggers the development of gonads into testes instead of ovaries, therefore determining the potential to be male. The SRY gene is called a Y-linked gene.

Question 34

Based on your knowledge of sex determination in humans and the information above, which one of the following statements is correct?

A. All daughters and sons of a male with a Y-linked trait will inherit the trait.

B. All grandsons of a male with a Y-linked trait will inherit the trait.

C. All male offspring of a mother with an X-linked dominant will must inherit the trait.

D. All sons of a father who has an X-linked dominant trait will inherit the trait.

Question 35

Males with Klinefelter syndrome have a diploid number of 47 due to having the sex chromosomes XXY. Symptoms include some breast development, abnormally big hips, tall height, infertility, and small testicles.

These males are infertile, as

A. they do not have the SRY and Fox9 genes needed for male development.

B. they cannot produce gametes because they cannot undergo prophase 1 of meiosis in their testes.

C. there are two copies of the X-linked sex genes, which switches off the Y-linked genes.

D. the SRY gene cannot activate the Sox9 gene, as the autosome on which the Sox9 gene is located is absent from their chromosome set.

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Use the following information to answer Questions 36–40.

There are many different genes that control blood types in humans by determining the protein antigen that is on the surface of the red blood cells. The features of three of these genes are shown in the table below.

Function of gene	Locus of gene	Alleles of gene
controlling Rhesus (Rh) blood type	chromosome number 1	D = Rh positive; d = Rh negative
controlling MN blood type	chromosome number 4	L^M = antigen produced; L^N = antigen not produced
controlling ABO blood type	chromosome number 9	I^A =antigen A; I^B = antigen B; i = neither antigen

Another gene located on chromosome number 1 is the gene controlling production of salivary amylase, the AMY gene, that has the alleles A = amylase produced and a = no amylase produced.

Question 36

The genes for the three types of blood groups shown above

A. could be described as linked genes, as they are all functioning in a similar manner for antigen production.

B. all have two alternative forms of the gene.

C. would all be inherited at two gene loci on one chromosome.

D. could only have two alleles of each gene present in the cells of a normal person.

Question 37

If a man and a woman, both heterozygous for the Rh positive blood type, had three children and all were Rh positive, the chance that the second child was heterozygous Rh positive would be

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{3}{4}$

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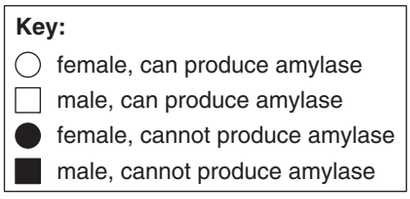
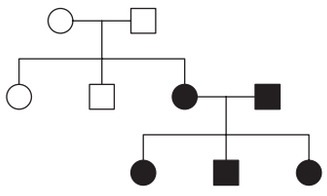
Question 38

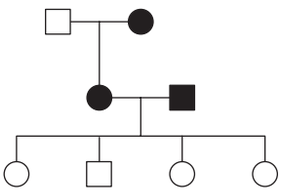
Which one of the following pedigrees shows the pattern of inheritance for the AMY gene?



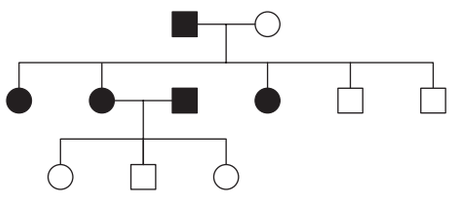
A.



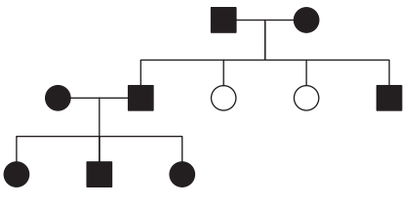
B.



C.



D.



Question 39

Carnivores such as cats do not produce salivary amylase, but herbivores such as rabbits or cows do.

What cross could be carried out to determine the genotype of rabbit Z,which can produce salivary amylase, assuming the pattern of inheritance is the same for rabbits as in humans?

A. Cross rabbit Z with another rabbit that could produce salivary amylase.

B. Cross rabbit Z with a rabbit that that could not produce salivary amylase.

C. Cross rabbit Z with a rabbit that was heterozygous for amylase production.

D. Cross rabbit Z with a rabbit that was homozygous for amylase production.

Question 40

A man who was heterozygous for Rh blood type and heterozygous for production of amylase married a woman who was Rh negative and could not produce salivary amylase. They had four children.

Based on your knowledge and the information given, what is the probability that their first child was Rh positive but unable to produce salivery amylase?

A. 75%

B. 25%

C. more than 75%

D. less than 25%

END OF SECTION A

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SECTION B

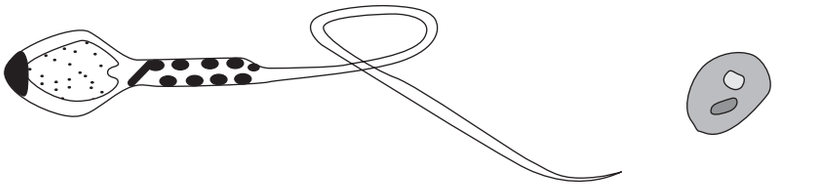
Instructions for Section B

Answer **all** questions in the spaces provided. Write using blue or black pen.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1 (7 marks)

The following diagrams are of two highly specialised cell types involved in the stage of fertilisation during sexual reproduction in animals and plants, including their approximate size.



sperm cell (50 μm) pollen grain (6 μm)

a. Are these two cell types be considered eukaryotic or prokaryotic cells? Justify your answer using evidence from the diagrams. 1 mark

Both cell types locate and fertilise an egg, but one of them cannot move independently and the other is highly mobile.

b. **i.** Name the cell which is highly mobile **and** identify the structural feature that the cell possesses to allow this mobility. 1 mark

ii. Examine the diagram of the cell named in **part b.i.**

Describe the importance of the cluster of oval, double-membrane bound organelles found in the mid-region of this cell. 1 mark

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c. The cell **not** selected in **part b.i.** is not able to move by itself but must still be able to reach the egg for fertilisation.

i. Suggest **one** way this cell may reach an egg. 1 mark

_____

_____

ii. Using the information in the diagram, identify a structural feature that may aid this cell to reach the egg. 1 mark

_____

_____

Neither of these cells, once mature, could be considered to be tissues.

d. **i.** What is meant by the term 'tissue'? 1 mark

_____

_____

ii. Why, when the two cells are mature, can they **not** be considered tissues? 1 mark

_____

_____

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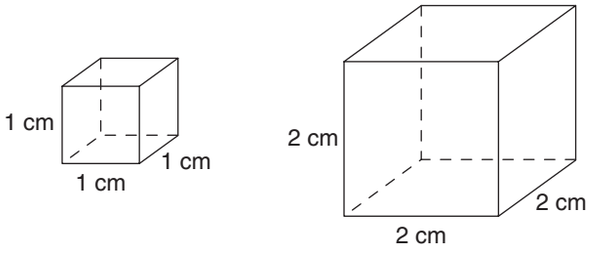
Question 2 (9 marks)

Sebastian, a Year 11 Biology student, decided to investigate absorption in roots of plants as his experimental investigation project. In the first part of the project, he cut potato tissue into nine cubes. Eight cubes were 1 cm^3 and one was 2 cm^3, as shown in the diagram below.



In the second part of the project, Sebastian patted each cube dry on paper towel, weighed them individually and recorded their initial mass. He then placed the eight 1 cm^3 cubes into beaker A, which contained 200 ml of distilled water. He placed the 2 cm^3 cube into beaker B, which also contained 200 ml of distilled water. After 5 minutes, he removed the cubes, patted them dry again and weighed them to record their final masses.

The following table shows the results for the nine cubes before and after immersion in distilled water for 5 minutes.

Cube size	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	2 cm^3
Initial mass (g)	0.62	0.69	0.59	0.63	0.71	0.62	0.58	0.61	1.18
Final mass (g)	1.11	1.25	1.18	1.22	1.29	1.19	1.13	1.09	1.43
Percentage change in mass (%)	44	45	50	48	45	47	48	44	17

a. Why was it a much better experimental technique to use eight 1 cm^3 cubes rather than only one cube of 2 cm^3 in size? 1 mark

b. Name and describe the process by which the potato cubes changed mass. 2 marks

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c. Which size cube showed a greater percentage change in mass after 5 minutes? Justify your response. 2 marks

Water is absorbed by the root cells of plants, especially in the root tip area. In this region, the root cells are of a similar size to other cells in the plant, but are structured differently to suit their function of absorption.

d. Draw a labelled diagram to show how these root cells are well adapted for absorption. 2 marks

e. Xylem tissue is important for transporting water and dissolved mineral salts upwards in the plant.

State **two** ways in which the xylem vessel cells are different in structure from other cells in the plant's stem **and**, for each, identify how this structural adaptation aids their function in transportation. 2 marks

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Question 3 (6 marks)

A significant disadvantage of wastewater treatment plants is their carbon footprint. Researchers have now found a way to reduce carbon emissions from sewage and simultaneously produce useful hydrogen energy. The method uses purple bacteria and electrical currents acting on the organic matter that is flushed down the toilet daily.

Purple bacteria belong to the largest and most diverse group of bacteria. They are phototrophic, using infrared light as the energy source for their metabolism. They are pigmented with bacteriochlorophyll a and bacteriochlorophyll b and other pigments called carotenoids. This results in their colour ranging from brown to red, orange and purple.

a. Would these purple bacteria be classified as photosynthetic autotrophs, chemosynthetic autotrophs or heterotrophs? Justify your response using each of the appropriate terms. 2 marks

_____

_____

_____

_____

Most plants and algae are green in colour compared to the purple bacteria.

b. Complete the following statement for green plants and algae: 2 marks

Green plants carry out a chemical process in which they capture and convert _____ energy and transform it into _____ energy which is stored in complex molecules of _____. In this process, the by-product of _____ is released.

The purple bacteria being used in biofuel research are placed in three different genera: *Rhodomicrobium*, *Rhodopseudomonas* and *Rhodospirillum*. However, all three are classified in the same family: *Rhodospirillacae*.

c. **i.** What is the difference between a genus and a family in classification? Explain using the purple bacteria as an example. 1 mark

_____

_____

_____

ii. Suggest **one** major advantage of using the same classification system in research programs in science laboratories all over the world. 1 mark

_____

_____

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Question 4 (9 marks)

The coastal temperate rainforests of Canada are sometimes called 'salmon forests', as salmon nourish these rich, complex terrestrial habitats. Salmon are aquatic, so their relationship with the rainforest is indirect. When salmon die at the end of their life cycle, bears drag their carcasses into the forest where eagles and other birds feed on the rotting fish carcasses. These actions fertilise the forest, including adding an important amount of nitrogen to the soil.

a. **i.** What is the difference between aquatic and terrestrial environments? Refer to the salmon and bear in your response. 1 mark

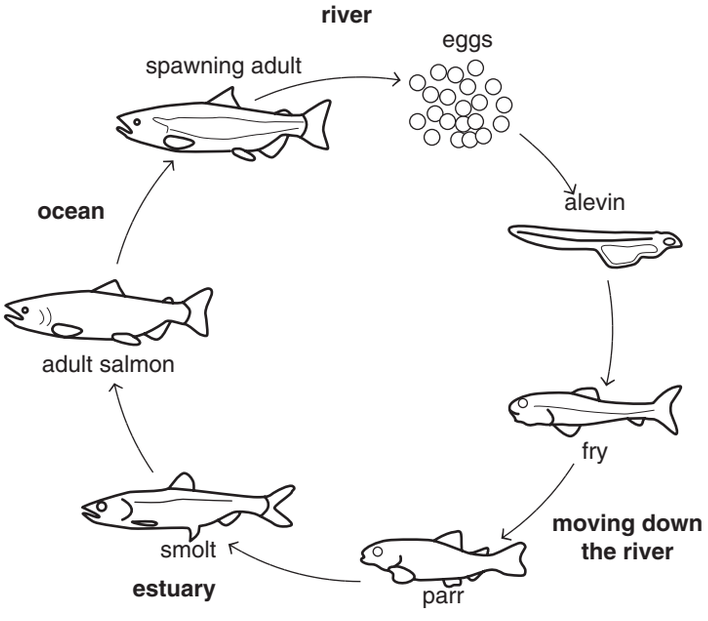
_____

_____

ii. What term is used for organisms such as the eagles who feed on the rotting fish carcasses? 1 mark

_____

Examine the following diagram of the life cycle of salmon through the river, estuary, ocean and back, as shown by the direction of the arrows.



b. Suggest **one** physiological adaptation that smolts may display to make them better adapted to the increasingly salty/brackish water environment. 1 mark

_____

_____

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In the estuaries where the river and sea water meet, brackish water supports salt-tolerant plants such as eel grass and sea asparagus. Abundant nutrients from the river and sea mix in this region. Plankton are in large quantities in this area. Salmon feed on foods found in amongst the plants, such as small invertebrates and herring eggs as well as small fish. The small fish feed on small invertebrates and plankton.

c. **i.** Use the above information to name the main producers that 'fuel the estuary food chains' **and** explain how this estuary environment increases the population density of these organisms. 1 mark

_____

_____

_____

ii. Using the above information, draw a possible food web involving the salmon in the estuary environment. 2 marks

iii. Explain why the arrows are drawn pointing in the direction shown in your answer to **part c.ii.** 1 mark

_____

_____

iv. What is the original source of energy for this food web? 1 mark

_____

_____

v. Name **one** organism in the food web above that is found at the third trophic level **and** write the food chain that supports this answer. 1 mark

_____

_____

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Question 5 (9 marks)

Dutch and Danish researchers have discovered a 'horrible fungus', *Entomophthora muscae*, that lives on houseflies, feeding off them, reproducing inside them and eventually killing them.

A spore from the fungus settles on a housefly, germinates and then infects the fly. The threads of the fungus spread through the body of the fly to its brain, whereby the fungus can manipulate the fly's behaviour and force it to crawl to the top of a branch. Here it will die with its wings spread to make it more noticeable, while the fugus produces a glue-like substance to stick the fly's dead body to the branch. The fly's body is digested and transformed into a mass of fluffy white filaments that are extremely attractive to other houseflies, which then inspect and touch the dead body. Their motion sets off tiny cannon-like fungal stalks with spores on their tips. These spores are sprayed over nearby flies or carried high up into air currents.

a. **i.** What is the name of the relationship between the fungus and the housefly? 1 mark

_____

ii. Justify your answer to **part a.i.** In your response, refer to both organisms. 1 mark

_____

_____

b. What is the advantage for the fungus by using the cannon-like stalks? 1 mark

_____

_____

The scientific name for the fungus is *Entomophthora muscae*; the name for the housefly is *Musca domestica*. Both names contain '*musca'* but in different positions in their scientific name.

c. Explain the significance and position of the word *muscae/musca* in each of the scientific names. 2 marks

_____

_____

_____

_____

Such impressive projectile weapons as those possessed by this fungus are rarely seen in animals and fungi. Scientists are hopeful that they can build a 'cannon' using the principles of the fungus to attack other insect pests. The structure designed uses a rubber-like tube with a minute plastic 'bullet' jammed in the top and a syringe to inject water, which builds up pressure to shoot the 'bullet'.

d. **i.** What is the name of the process, as in the development of the fungal 'cannon', that applies to designs inspired from nature to develop inventions that will help to solve human problems? 1 mark

_____

ii. Give another example of the process named in **part d.i.** 1 mark

_____

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Some people have expressed considerable concern that the use of such techniques could impact enormously on ecosystems. Important insects such as bees, flies and other insects are already decreasing in numbers; figures of decreases up to 40% have been suggested from recent research.

e. Identify **two** of the crucial roles played by insects in ecosystems that may result in ecosystem collapse if their numbers are markedly decreased. 2 marks

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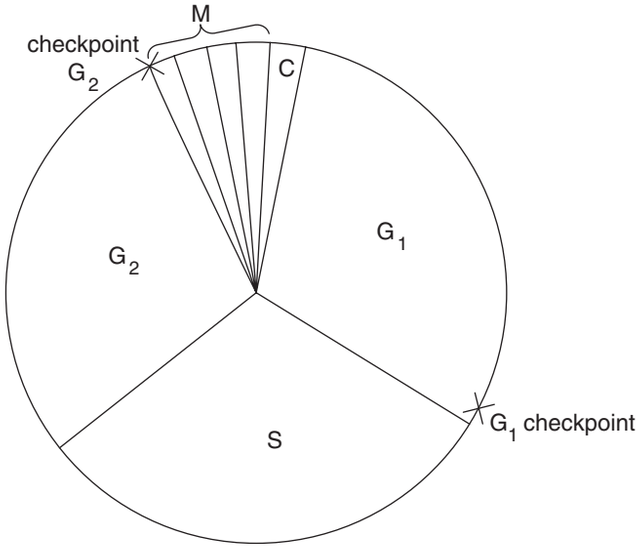
Question 6 (3 marks)

The DNA molecule contains all the information needed for the structure and functioning of the cells. Every time DNA replicates in the cell cycle, there is a chance that an error or mutation could occur. To ensure that any mutations in the DNA are repaired before the final cell division at the end of the cell cycle, there are checkpoints in the cycle. If there is DNA damage or some other problem, a group of chemicals called CDK inhibitors will inhibit and stop the cell cycle. CDK promoters will allow the cycle to progress if no damage or other problems are detected. These checkpoints are shown on the simplified cell cycle diagram below.



Checkpoint G_1 is located towards the end of G_1 before DNA synthesis occurs.

a. Why would it be necessary to checkthe size of the cell and for any damage to the DNA at the G_1 checkpoint? 1 mark

Checkpoint G_2 is located at the end of G_2 after DNA synthesis and G_2 are complete.

b. Why would it be important to have a checkpoint here? 1 mark

Two types of genes play an important role in regulating the cell cycle: proto-oncogenes which stimulate cells to grow and divide, and tumour-suppressor genes, which inhibit cell division. If the activities of these two gene types are in balance, normal body cells will divide at an appropriate rate for their position in the body and their function. If a mutation occurs in one of the two gene types, a person may have a genetic predisposition that results in an increased risk of developing a disease.

c. What type of disease would be likely if there was a mutation in these genes? 1 mark

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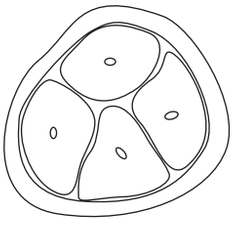
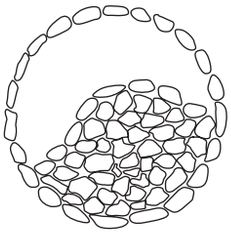
Question 7 (7 marks)

The diagrams below show four sources of stem cells which can be harvested and cultured in the laboratory.

I. four-cell embryo

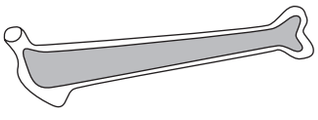


II. inner cell mass of blastocyst



III. umbilical cord blood from newborn

IV. adult bone marrow



The different sources of stem cells produce different types of stem cells.

a. What are the **two** unique features common to all four types of stem cells? 2 marks

_____

_____

b. **i.** Cell types III and IV are referred to by the term 'multipotent'.
What term is used for cell type I? 1 mark

_____

ii. Why is a different term used for type I stem cells compared to types III and IV? 1 mark

_____

_____

c. Outline **one** ethical issue that has resulted in considerable debate associated with the use of stem cells sourced from types I and II. 1 mark

_____

_____

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People seriously burnt in the volcanic blast that occurred in New Zealand in late 2019 collectively needed metres of skin for skin grafts.

d. **i.** Which of the four cell types would be best for generating skin tissue? Explain why. 1 mark

_____

_____

ii. What is **one** disadvantage of using stem cell-generated skin tissue that is **not** derived from the person's own cells? 1 mark

_____

_____

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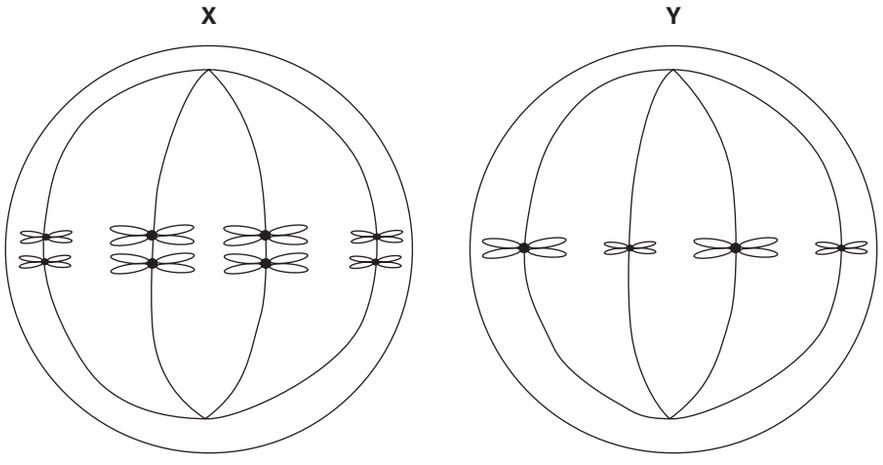
Question 8 (15 marks)

The two cell types shown in the diagram below are found in the same organ of a *Drosophila* fly and are two stages of the same process.



a. **i.** Name the process shown in the above diagrams **and** the organ in a fly in which it would occur. 2 marks

_____

_____

ii. Name the **two** different stages of the process shown in X and Y. 1 mark

_____

_____

iii. The names of the two stages of the process share a word in common.

What happens in the process that justifies the use of the same word in both names? 1 mark

_____

_____

iv. One number is different in the names of the two stages of the process.

What happens in the process that requires the use of different numbers in the two names? 1 mark

_____

_____

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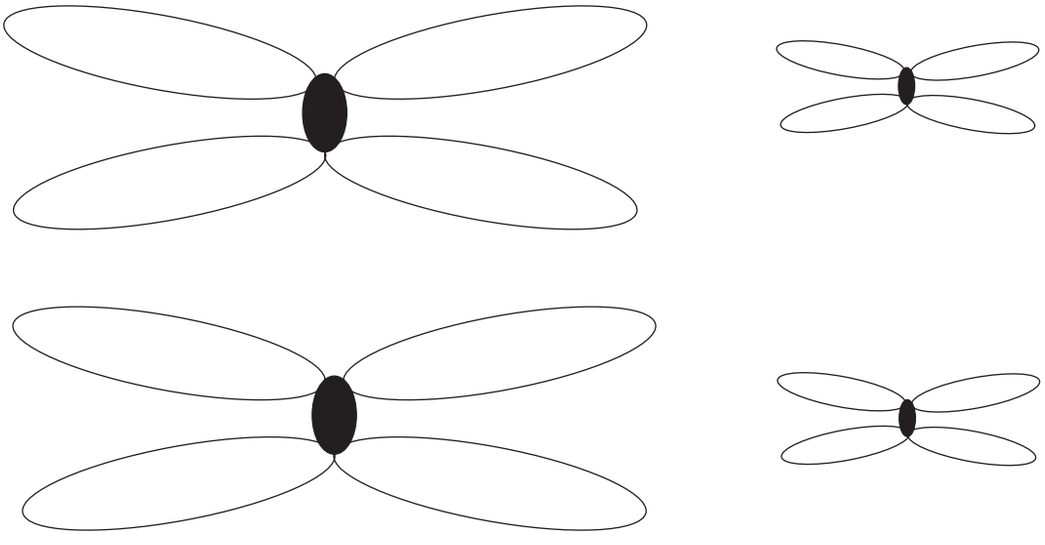
b. **i.** On the diagrams on the previous page, circle **one** pair of homologous chromosomes **and** identify why they are called homologous chromosomes. 2 marks

_____

_____

ii. The following diagram shows four chromosomes belonging to an fly that is homozygous dominant for trait G, heterozygous for trait H and homozygous recessive for trait A. G, H and A are linked genes.

On the diagram below, mark the positions of each allele on each chromatid using the letters G, H and A. 3 marks



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c. The gene for the trait B, gene B, is not linked to genes G, H and A.

i. The fly is homozygous recessive for gene B.

On the diagram in **part b.ii.**, mark the position of the alleles of gene B. 1 mark

ii. If 100 *Drosophila* flies that were heterozygous for genes G and H were crossed with 100 flies homozygous recessive for genes G and H, what would be the predicted ratio of the four types of offspring? 1 mark

_____

_____

iii. What is the name of the type of cross described in **part c.ii.**? 1 mark

_____

iv. 100 *Drosophila* flies that were heterozygous for genes G and B were crossed with 100 flies homozygous that were recessive for genes G and B.

Is the predicted ratio the same as the ratio given in **part c.ii.**? Justify your answer. 2 marks

_____

_____

_____

_____

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Question 9 (11 marks)

Two Year 11 Biology students were discussing various genetic disorders and diseases. Peggy said her neighbours had a daughter, Matilda, with Down's syndrome, and explained that Matilda inherited it as an autosomal dominant trait, as it affected features of her body. Jack disagreed with Peggy. He used inheritance of Huntington's disease as an example of an autosomal dominant disorder.

a. Explain the meaning of the phrase 'autosomal dominant trait'? 2 marks

Peggy's teacher told her she was incorrect and needed to do more research on Down's syndrome. Peggy found that Down's syndrome occurs due to a problem during meiosis in one of the parents' sex organs, resulting in one of the gametes carrying an extra chromosome.

b. **i.** What is the name given to a disorder where there is an extra chromosome in the chromosome set of a person? 1 mark

ii. Draw and label Matilda's karyotype. Show the last four pairs of autosomes, labelled with pair numbers 19, 20, 21 and 22, and her sex chromosomes, labelled appropriately. Indicate the diploid number for Matilda's cells. 3 marks

Diploid number for Matilda's cells _____

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The teacher told Jack that his example was correct, as the trait for Huntington's disease is dominant. The disease has a late onset and the symptoms most commonly appear in people between 30–50 years of age. Jack decided to do a Punnet square diagram to determine the probability of an unaffected woman and a man, heterozygous for Huntington's disease but showing no symptoms at 25 years old, having a child with the potential to develop Huntington's disease.

c. **i.** Assigning appropriate symbols for the alleles, show the Punnet square diagram Jack would have drawn **and** state the probability of the child having Huntington's disease. 2 marks

Probability of the child having Huntington's disease _____

ii. Could a heterozygous offspring be a carrier? Justify your response. 1 mark

_____

_____

iii. Jack then drew a pedigree of three generations to conclusively show that the inheritance of Huntington's disease is autosomal dominant, not recessive or sex-linked.

In the following space, draw an example of this pedigree. 2 marks

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Question 10 (4 marks)

In 2019, a company offered an online promotion over the Christmas period, offering up to 50% off the price of DNA home testing kits. There were a variety of kits offered, the most expensive and comprehensive being a Premium DNA Test Kit for Health (testing for the risk of common health conditions and diseases), Vitality (testing for nutrition, skin, stress, ancestry) and Family Planning. The test kit contained a code to activate an official app, the materials required to collect an inner-cheek cell swab and a package in which to return the sample.

a. **i.** Why is it necessary for the person who purchases a kit to take a swab of their inner-cheek cells? 1 mark

_____

_____

ii. The test involves complete exome sequencing technology.

What is being analysed in this process? 1 mark

_____

_____

iii. What may the sequencing result indicate that would be beneficial for family planning? 1 mark

_____

_____

b. This type of genetic screening can be carried out on embryos as well as adults. There are, however, several social and ethical implications regarding such tests.

Identify **one** of these implications. 1 mark

_____

_____

END OF QUESTION AND ANSWER BOOKLET

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Trial Examination 2020

VCE Biology Units 1&2

Written Examination

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out. Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: [A] [B] [C] [D]

Use pencil only

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D

15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D
21	A	B	C	D
22	A	B	C	D
23	A	B	C	D
24	A	B	C	D
25	A	B	C	D
26	A	B	C	D
27	A	B	C	D
28	A	B	C	D

29	A	B	C	D
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32	A	B	C	D
33	A	B	C	D
34	A	B	C	D
35	A	B	C	D
36	A	B	C	D
37	A	B	C	D
38	A	B	C	D
39	A	B	C	D
40	A	B	C	D

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