West Spring Secondary School
PRELIMINARY EXAMINATION 2018

BIOLOGY

6093/01

SECONDARY 4 Express

Name _____ ( ) **Date** 03 Sep 2018

Class _____ **Duration** 1 hour

Additional Materials: 1 OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper-clips, highlighters, glue or correction fluid.
Write your name and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions.
For each question there are four possible answers **A, B, C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of approved scientific calculators is allowed for this paper.

This document consists of **15** printed pages including the cover page.

Setter(s) Ms Zhou Siyang **[Turn over**

1 Some organisms live at the bottom of the seas where it is very dark. To synthesise glucose, they use energy from chemicals in the very hot water that comes out of volcanoes.

What is a distinguishing feature of these organisms?

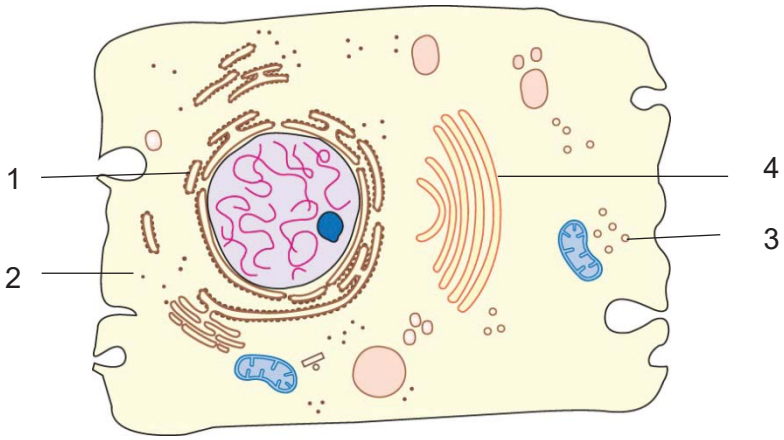
A They do not need oxygen.
B They do not contain chloroplasts
C They do not contain mitochondria.
D Their enzymes are easily denatured by heat.

2 What are the similarities between a neurone and a sieve tube element in phloem?

1 Both lack nuclei.
2 Both are living cells.
3 Both are specialised cells.
4 Both have large surface areas to volume ratio.

A 3 only
B 1 and 4 only
C 2 and 3 only
D 1, 2 and 3 only

3 The diagram shows a typical animal cell with cell components that are involved in the synthesis and secretion of an enzyme.

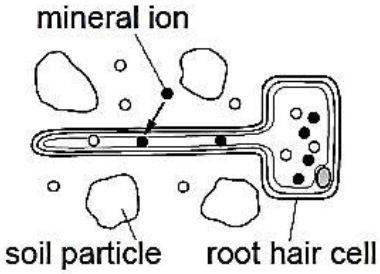


Which of the following identifies correctly the route taken by an amino acid molecule from the point it is synthesised and as it passes through these cell components?

A 2 → 4 → 1 → 3
B 2 → 1 → 4 → 3
C 3 → 2 → 1 → 4
D 3 → 4 → 1 → 2

4 Which diagram illustrates the process of active transport?

A



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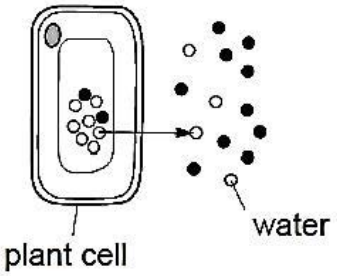

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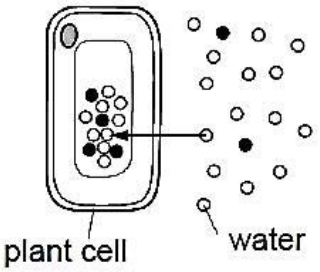

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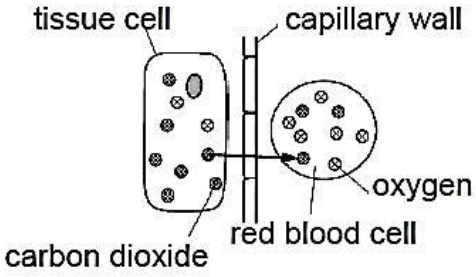
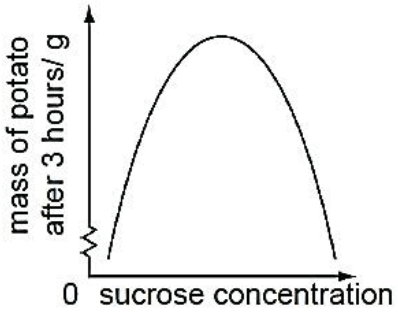


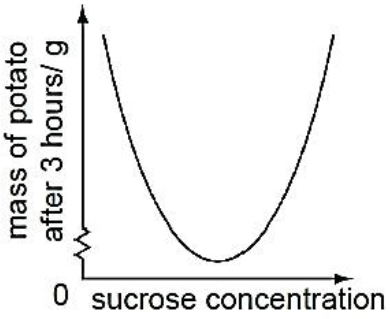
5 Identical pieces of potato are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured.

Which graph shows the results of this experiment?

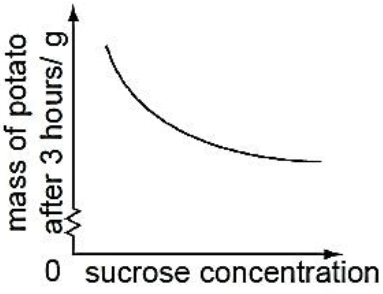
A



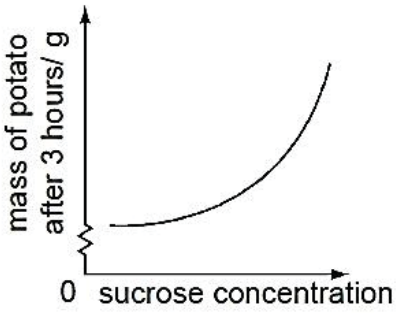
B



C



D



6 In lactose intolerance, insufficient lactase is produced to digest lactose into molecules small enough to be absorbed by the small intestine. The lactose remains in the lumen of the small intestine and the contents of the small intestine become more hypertonic than usual. Which of the following would be a consequence of this?

A More water will be absorbed by the walls of the small intestine.
B Less lactose will remain in the lumen of the small intestine.
C The intestinal contents become very dry.
D The intestinal contents will contain more water.

7 A student was asked to identify the two food substances in each of three test-tubes.

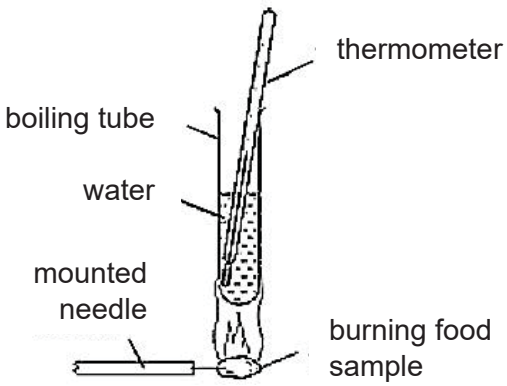
The table shows the results of the student's tests.

test - tube	reagent added to test-tube		
	Biuret solution	Benedict's solution	iodine solution
X	purple	brick-red	brown
Y	blue	blue	blue-black
Z	purple	blue	blue-black

Which conclusion is consistent with the results?

A Egg white and sucrose had been placed in tube X.
B Maltose and starch had been placed in tube Z.
C Maltose and sucrose had been placed in tube X.
D Starch and sucrose had been placed in tube Y.

8 Four equal masses of different foods were burned as shown.



The temperature of the water was measured before and after each food sample was burned. The results are shown in the table. Which food sample is likely to contain the most fats?

	water temperature at the start/°C	water temperature at the end/°C
A	16	37
B	17	95
C	18	87
D	19	22

9 The following is a list of laboratory steps.

1 add copper(II) sulfate drop by drop
2 shake well to mix
3 place in a boiling water-bath
4 add Benedict's solution
5 add sodium hydroxide solution

Arrange the steps in the order which they need to be carried out to show the presence of a protein.

A 4 → 1 → 2 → 3
B 4 → 2 → 3
C 5 → 2 → 1 → 3
D 5 → 2 → 1

10 A scientist investigated four species of insects. As all the insects look physically familiar, he investigated the digestive enzymes found in their guts.

From the data that he gathered, which insect feeds **only** on human blood?

insect	enzyme(s) present in insect guts			
	amylase	protease	sucrase	lipase
A	-	-	-	+
B	+	-	+	-
C	-	+	-	+
D	+	+	+	-

key: + present; - absent

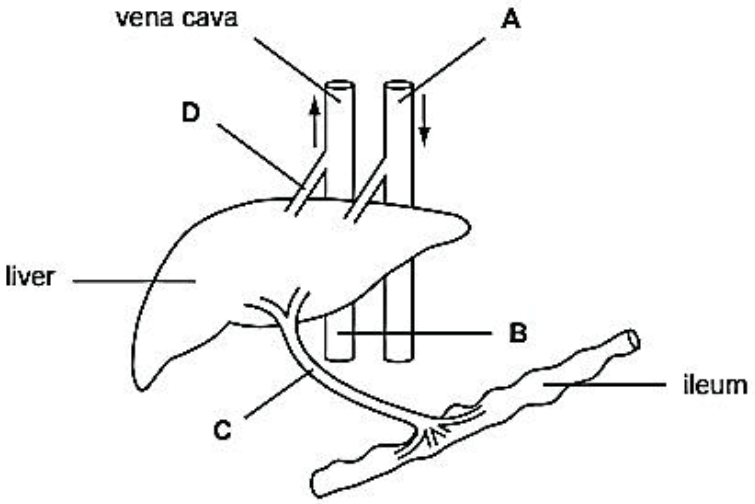
11 Cubes of hard-boiled egg white are placed in test-tubes containing 5 cm^3 of water. Other substances are added to each tube as shown in the chart. The tubes were left for eight hours and then tested for amino acids.

tube	solution added	results for amino acids
1	pepsin	absent
2	pepsin + alkali	absent
3	none	absent
4	pepsin + acid	large amounts
5	boiled pepsin + acid	traces
6	acid	traces
7	alkali	absent

Which tubes show that pepsin is an enzyme?

A 1 and 6
B 2 and 7
C 4 and 5
D 5 and 6

12 The diagram shows the liver and its associated blood vessels.

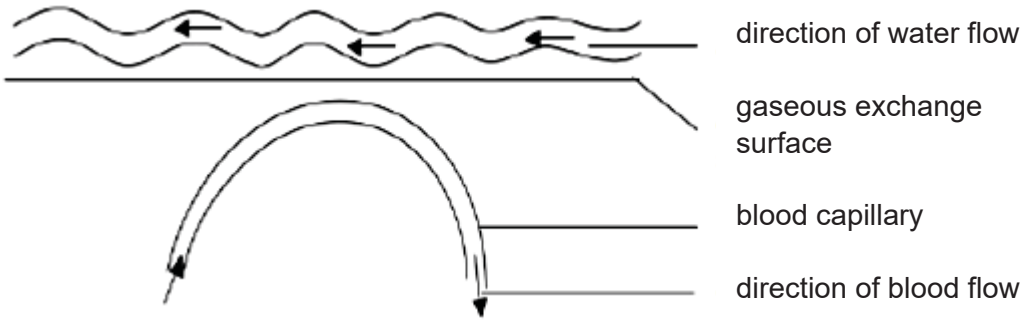


If a person is fasting, which blood vessel would have the highest concentration of glucose after 24 hours?

13 Which row shows the most likely number of chloroplasts in three types of cell in a leaf?

	vascular bundle cell	epidermal cell	mesophyll cell
A	15	8	8
B	8	15	8
C	0	8	15
D	0	0	15

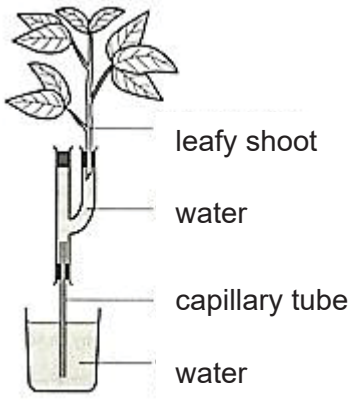
14 The diagram represents the gaseous exchange on the surface of a fish.



Which conditions would result in the maximum rate of diffusion of oxygen across the gaseous exchange surface?

	amount of dissolved oxygen in water	amount of dissolved oxygen in blood plasma	rate of blood flow
A	large	small	fast
B	large	small	slow
C	small	large	fast
D	small	large	slow

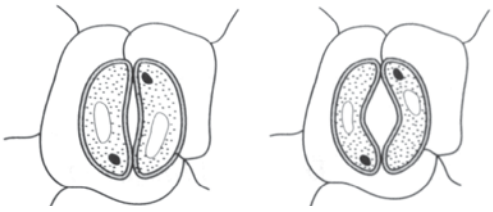
15 The diagram illustrates a simple potometer which measures water uptake in plants.



Which combination of conditions would result in the fastest uptake of water?

A bright light and humid air
B bright light and high temperature
C high humidity and high temperature
D moving air and low temperature

16 The diagram below shows the condition of a stoma at different times of the day.



X Y

Which of the following shows the most probable times at which the stoma is being observed?

	X	Y
A	1.50 pm	9.30 am
B	2.00 pm	7.30 pm
C	10.00 pm	11.00 am
D	11.30 pm	3.15 am

17 An experiment was conducted on a young plant, using an aphid stylet (mouth part) to measure the rate of translocation. The same plant was then placed in a bell jar together with a chemical which absorbs oxygen. It was observed that the rate of translocation decreased and eventually stopped.

Which of the following best explains the above observation?

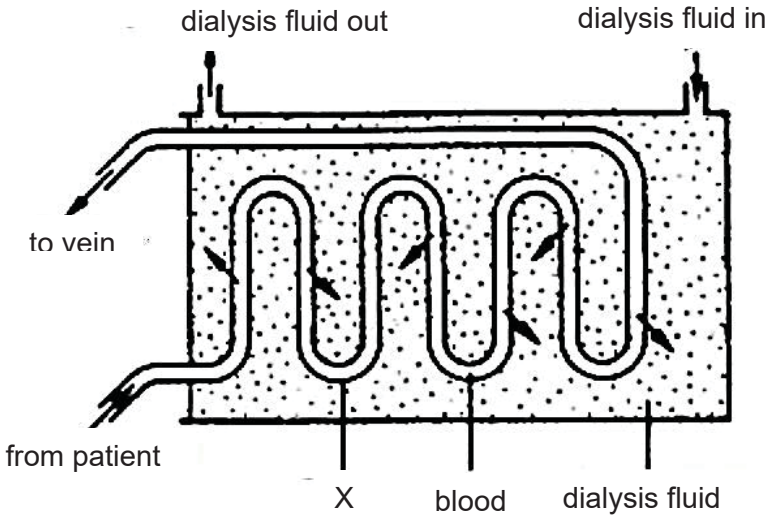
A Companion cells no longer produced sufficient energy.
B Mitochondria in the xylem vessels ceased to function.
C Photosynthesis could not occur in the plant placed in the bell jar.
D Translocation occurred only by diffusion.

18 The diagram shows someone blowing up a balloon.

How do the proportions of gases in the air inside the balloon compare with the air outside the balloon?

	oxygen	carbon dioxide	water vapour
A	more	less	more
B	more	less	less
C	less	more	more
D	less	more	less

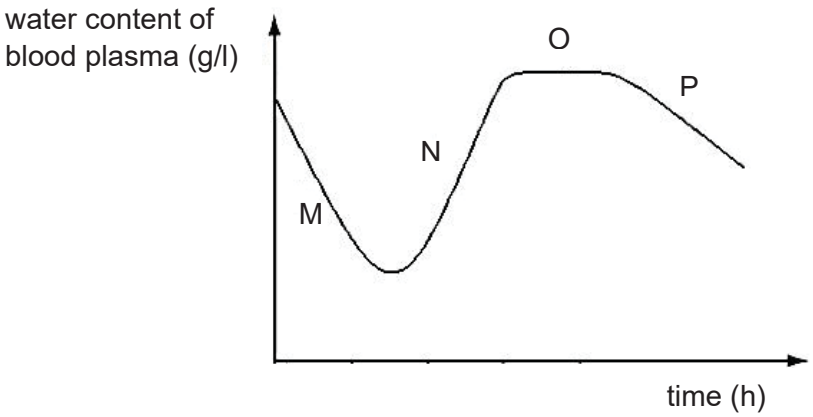
19 The diagram shows a dialysis machine.



Which process(es) does not happen along X?

A active transport
B diffusion
C osmosis
D osmosis and diffusion

20 The graph shows the effect of antidiuretic hormone (ADH) on the regulation of water content in blood plasma.



Which part(s) of the graph reflect(s) the effect of increased ADH secretion?

A M only
B N only
C M and P
D N and O

21 Which of the following statements about a voluntary action is true?

A It always involves the contraction of muscles.
B It always involves the spinal cord.
C It is always initiated by a sense organ.
D It is always initiated in the brain.

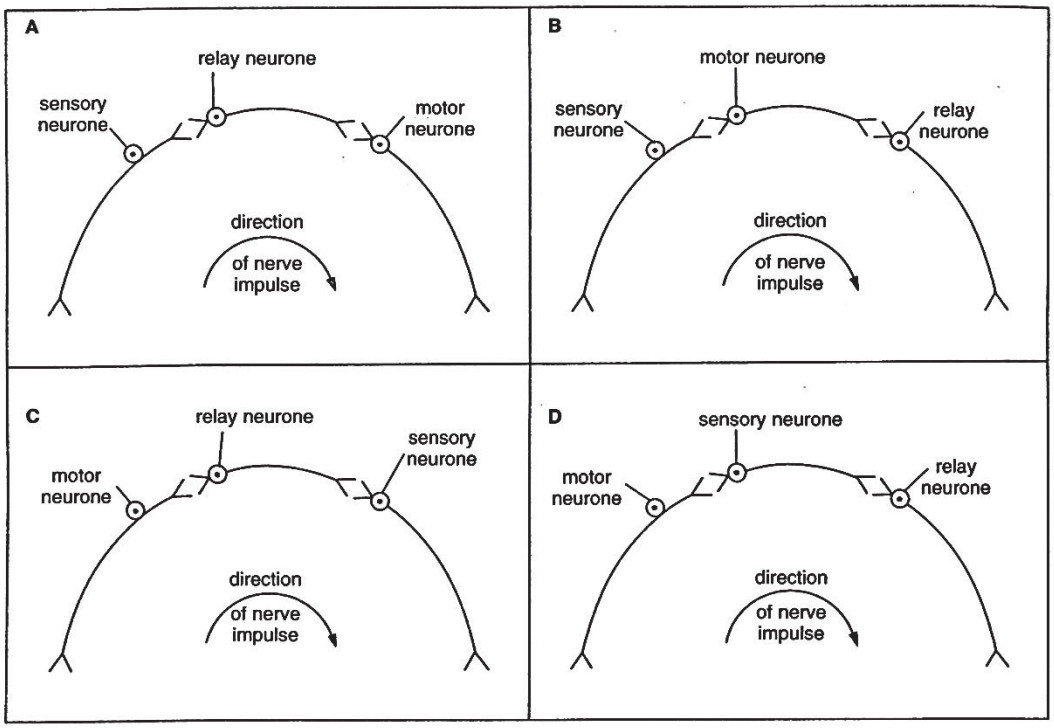
22 In an accident, a patient's spinal cord was severed at the neck region.

Which of the following are the possible effects of this?

1 inability to carry out reflex actions below the neck
2 inability to perceive sensory stimuli below the neck
3 inability to voluntarily move muscles below the neck

A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

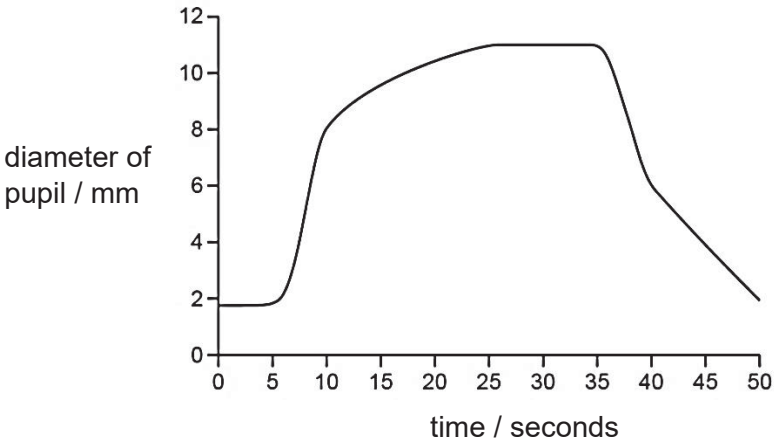
23 Which of the following diagrams, **A**, **B**, **C** or **D**, shows the correct sequence of neurons in a reflex arc?



24 Which structures cover the pupil at the front of a human eye?

A conjunctiva and sclera
B cornea and conjunctiva
C cornea and retina
D retina and sclera

25 The graph shows the changes in the size of the pupil of the eye as the light intensity of the surroundings is changed.

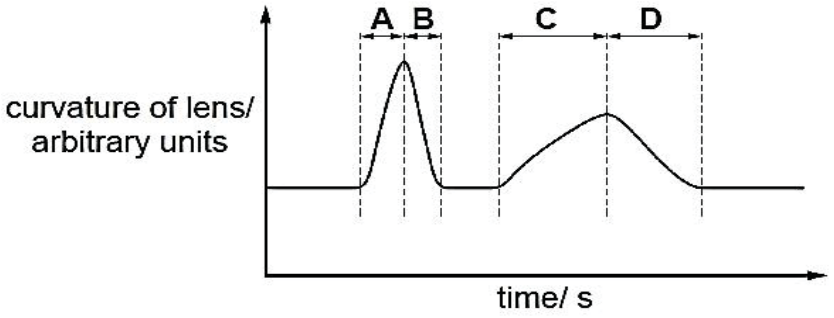


Between which times is the light intensity increasing?

A 5 to 10 seconds
B 10 to 25 seconds
C 25 to 35 seconds
D 35 to 40 seconds

26 The diagram shows the curvature of the lens in a person's eye. The shape of the lens changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving towards the person at the higher speed?



27 Glycogen can undergo the following chemical change:

glycogen → glucose

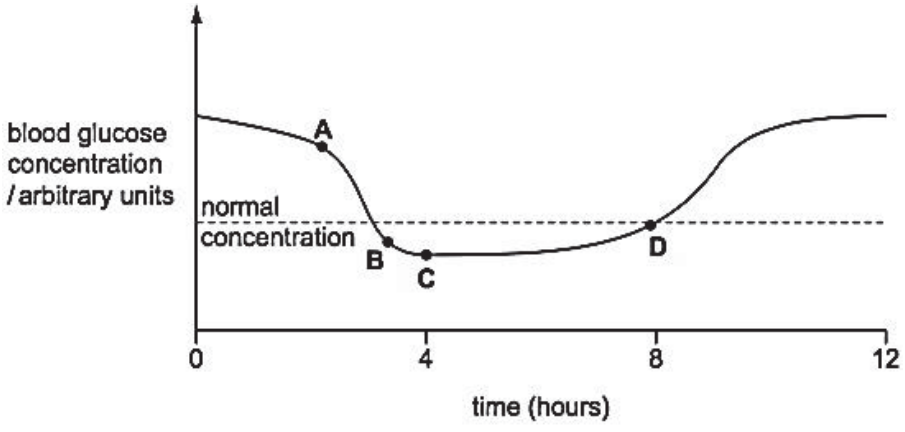
Which hormone(s) can be responsible for this chemical change?

	adrenaline	glucagon	insulin
A	√	x	√
B	√	√	x
C	x	√	x
D	x	x	√

Key:
√ = responsible
x = not responsible

28 A person with diabetes mellitus is receiving treatment with insulin injections. The graph shows how this person's blood glucose concentration changed during part of one day.

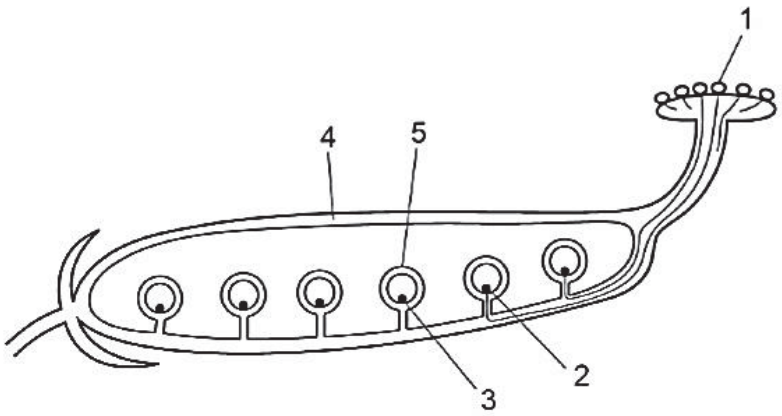
At which point was an insulin injection given?



29 Which of the following occurs in meiosis but **not** in mitosis?

A Chromatids of chromosomes cross and twist around each other.
B Chromosomes line up independently along the equator.
C Sister chromatids are held together at the centromere.
D Sister chromatids separate during anaphase.

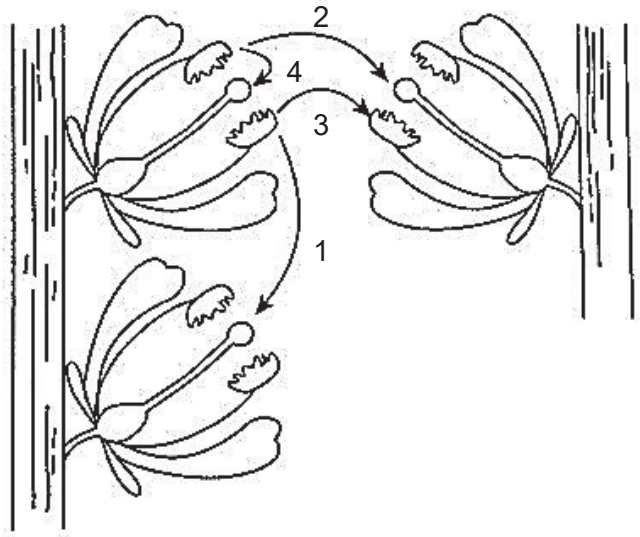
30 The diagram shows part of a flower after it has been pollinated.



Which labelled structures are diploid and which are haploid?

	diploid	haploid
A	1	4
B	2	1
C	3	2
D	4	5

31 The diagram below shows two plants of the same species.



plant 1 plant 2

Which arrow(s) indicate(s) a process that would lead to sexual reproduction?

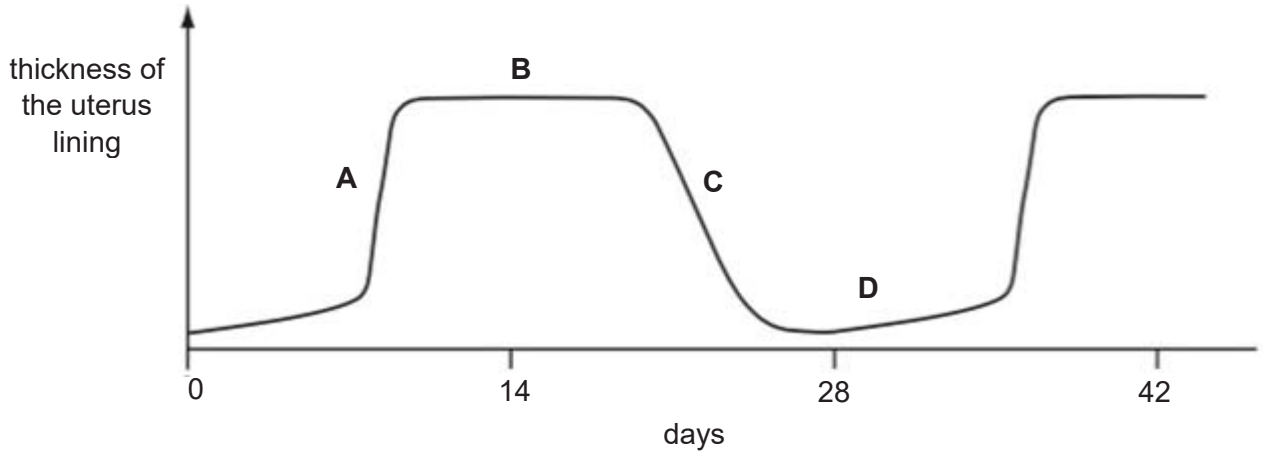
A 2 only
B 2 and 3
C 1, 2 and 3
D 1, 2 and 4

32 Which one of the following statements correctly describes the sequence of events that follows after the pollen grain lands on the stigma?

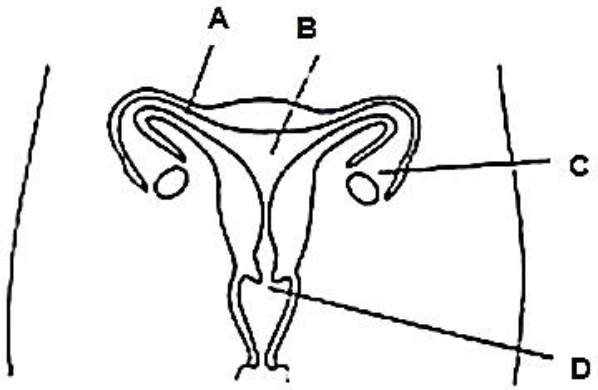
A The pollen grain forms a pollen tube which grows down the style to the ovule carrying the male gamete, which then fuses with the female gamete.
B The pollen grain passes down the style and fuses with the female gamete in the ovule.
C The pollen grain releases male gametes which digest their way through the stigma and style and then fuse with the female gametes in the ovule.
D The pollen grain releases male gametes which swim towards the ovule in the ovary, then fuse with the female gametes.

33 The diagram shows the changes in the thickness of the uterus lining of a woman during her menstrual cycle.

At which period of time is the woman most likely to be fertile?



34 You are a doctor treating a childless couple. Upon detailed study, you discover that the sperms from the husband are not strong enough to swim to meet the egg. As such, you decide to fertilise the egg in the laboratory and implant the embryo back into the wife. In the diagram, at which location would you place the embryo?

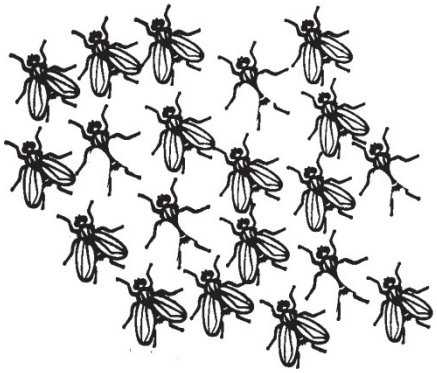


35 Genetic cross of pure bred red four o'clock flowers with pure-bred white four o'clock flowers resulted in F1-hybrid offspring that all had pink flowers. When the F1 plants were self-pollinated, the resulting F2-generation plants had a phenotypic ratio of 1 red: 2 pink: 1 white.

The most likely explanation is …….

A pink flowers are the result of a blending of the red and white genotypes.
B flower colour is due to two or more complementary genes.
C heterozygous plants have a different phenotype from the pure bred parents because of codominance of the dominant allele.
D flower colour inheritance in four o'clock flower does not obey Mendelian laws.

36 The drawing shows fruit flies produced in a genetic experiment. The number of each type represents the ratio resulting from crossing two types of flies.



Assume that F represents the dominant allele and f represents the recessive allele involved in the cross.

Which of the following crosses would produce this ratio?

A FF x FF
B FF x ff
C Ff x Ff
D Ff x ff

37 A person with Down's syndrome is born with 47 chromosomes in each cell, instead of 46.

What could cause this?

A More than one sperm fused with the egg at fertilisation.
B Mutation happened during the production of the egg cell.
C Radiation caused a change in structure of a gene in the father's sperm.
D The mother was exposed to harmful chemicals while she was pregnant.

38 How many adenine molecules are present in a DNA molecule of 4000 bases, if 20% of the base molecules are cytosine?

A 600
B 800
C 1200
D 2400

39 Which of the following statements correctly describes an advantage that genetic engineering has over artificial selection?

A It is a quicker process, as only one species is required for beneficial traits to be passed down to offspring.
B It always creates organisms that are more suited to their natural environment.
C Genetically modified food is always more nutritious and safe for all consumers.
D There is a higher chance of offspring receiving the beneficial trait from the genetically engineered parent compared to using artificial selection.

40 The diagram shows the positions of four farms and the concentrations of nitrate at different points in a river.

Which farm is likely to have been using too much fertiliser on its land?