NAME:	CLASS:	NO:

RAFFLES INSTITUTION

2016 END OF YEAR EXAMINATION

Subject : SCIENCE

Level : YEAR 2

Date : 13 Oct 2016 (Thursday)

Time : 0800 – 0945 (1 h 45 min)

INSTRUCTIONS

1. Do not turn over the page until you are told to do so.
2. Write your **name**, **index number** and **class** in the spaces at the top of this page, the top of each section and on the OTAS sheet.
3. Read all instructions and questions carefully.
4. This paper consists of **FOUR SECTIONS**.
   - **Section A**
     Answer **all** questions on the OTAS sheet.
   - **Sections B, C,** and **D**.
     Answer **all** questions in the spaces provided.
     Bonus questions (marked with *) are optional.
5. All working must be shown.
6. The use of a calculator is allowed.
7. Candidates are reminded that all quantitative answers should include appropriate units and should be given a sensible number of significant figures. Errors in units and numbers of significant figures will be penalized.
8. After the examination, please hand in the following **separately** to your invigilator:

- OTAS sheet
- Sections A and B booklet
- Section C booklet
- Section D booklet

FOR EXAMINER'S USE

Section	Marks
A	
B	
C	
D	
Total	**/75**

THIS QUESTION PAPER CONSISTS OF 22 PRINTED PAGES **EXCLUDING THE COVER PAGE.**

Section A (25 marks)

*Answer **ALL** Questions*

*Four possible answers **A**, **B**, **C** and **D** are given for each question. Choose the most appropriate answer and record it on the OTAS answer sheet provided.*
A copy of the Periodic Table is given on Page 10.

1 Which statement is true for a nitride ion?

A It has an equal number of protons and electrons.
B It has more protons than electrons.
C It has the same charge as a fluoride ion.
D It has the same number of electrons as a neon atom.

2 Element **Y** forms a covalent compound with fluorine with the formula YF_3.
Which Group of the periodic table could **Y** be in?

A Group I
B Group II
C Group V
D Group VII

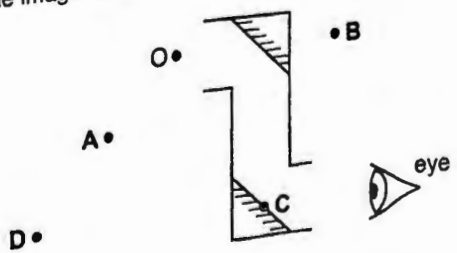
3 What is a property of ammonia?

A It conducts electricity in aqueous state.
B It has a giant lattice structure.
C It is a liquid at room temperature and pressure.
D It turns moist blue litmus paper red.

4 Which pair of substances react to form effervescence?

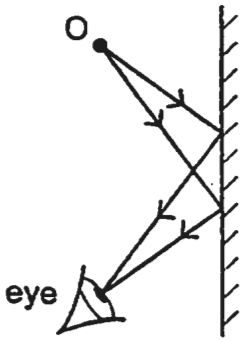
	substance 1	substance 2
A	copper	sulfuric acid
B	hydrochloric acid	ammonia
C	sodium	water
D	zinc chloride	nitric acid

5 The diagram shows an object **O** viewed using two mirrors. A person looks into the mirrors as shown. Where is the image of **O**?

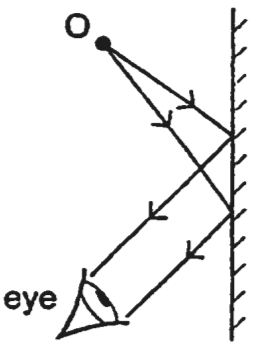


6 An eye views an object O by reflection in a plane mirror.

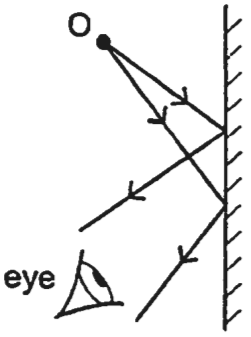
Which is the correct ray diagram?



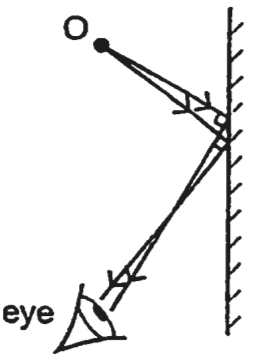
A



B

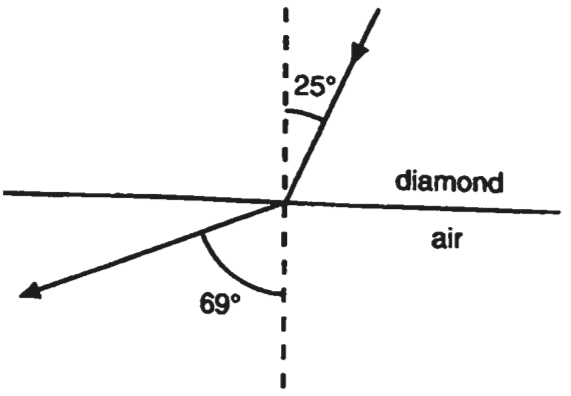


C



D

7 The diagram shows a ray of light moving from diamond to air.

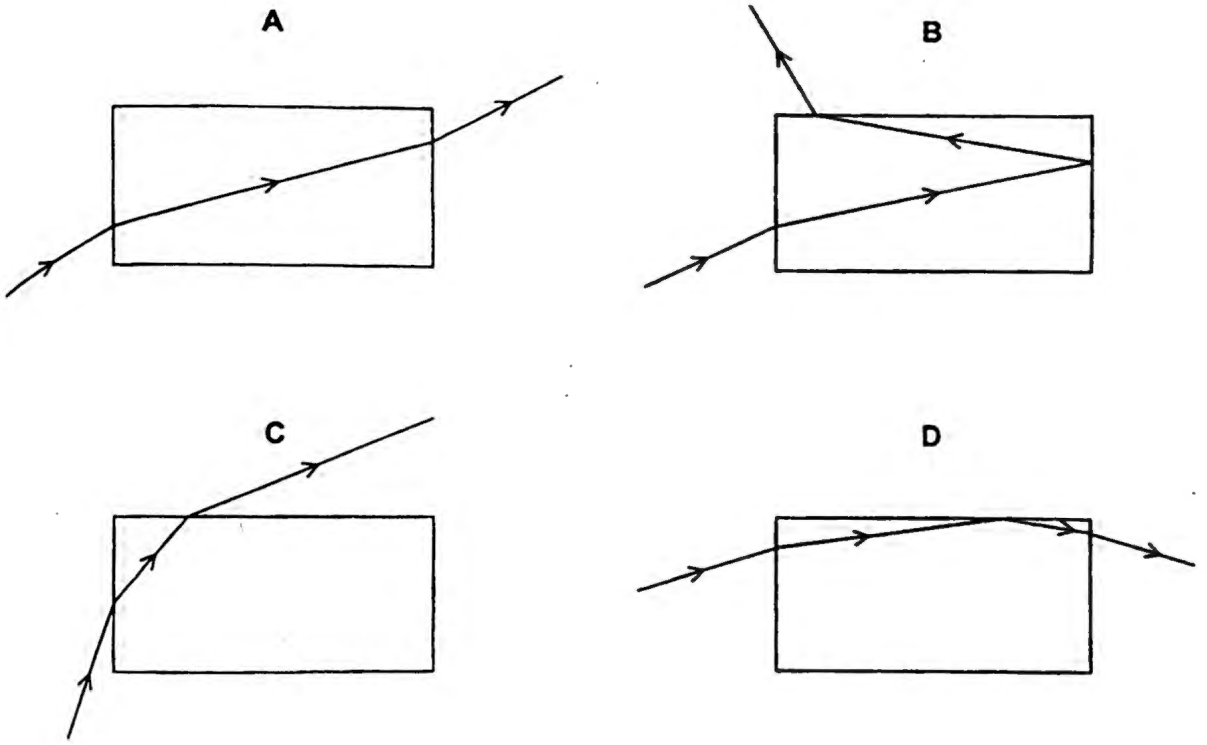


What is the critical angle of diamond?

A 21°
B 27°
C 63°
D 65°

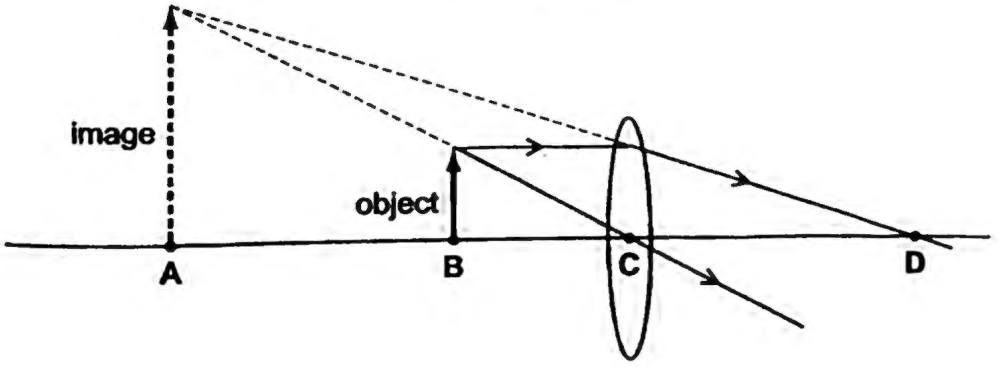
8 A ray of light is incident on one side of a rectangular glass block. Its path is plotted through the block and out through another side.

Which path is **not** possible?



9 The diagram shows the action of a magnifying glass.

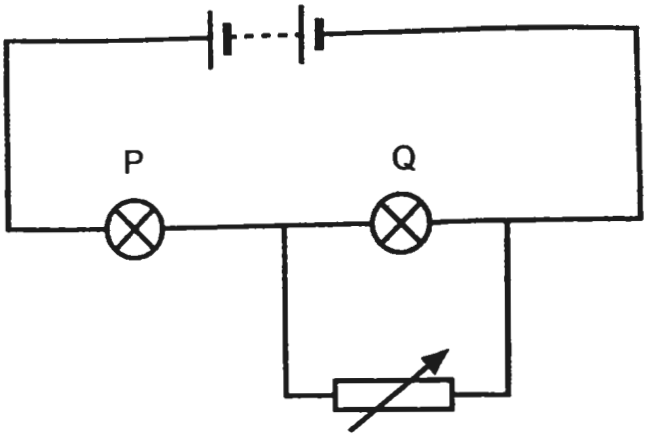
Which point is the principal focus (focal point) of the lens?



10 When an object is placed 40 cm from a thin converging lens, a real image of equal size to the object is formed. The object is then moved 10 cm towards the lens. Which of the following describes the new image formed?

	image distance from lens	image size
A	less than 40 cm	diminished
B	less than 40 cm	magnified
C	more than 40 cm	diminished
D	more than 40 cm	magnified

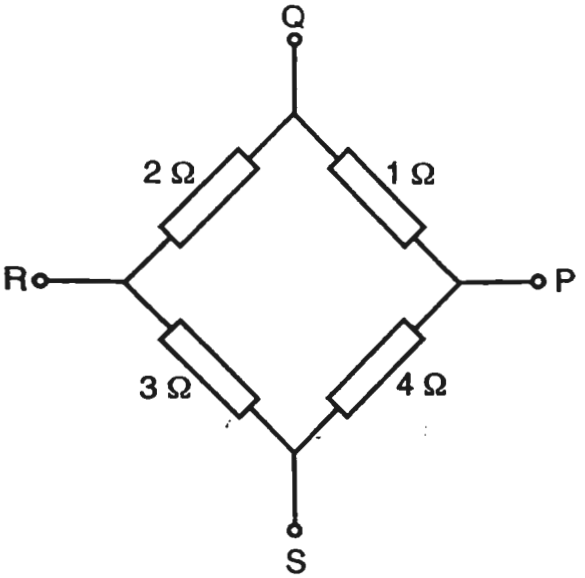
11 What will happen to the brightness of the lamps **P** and **Q** if the resistance of the rheostat is increased?



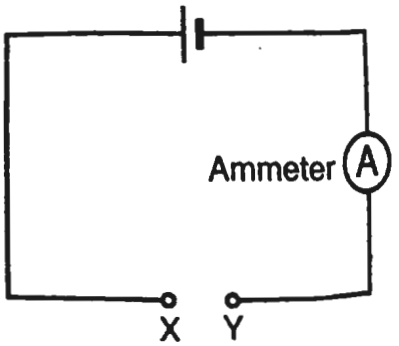
	lamp P	lamp Q
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

12 Two of the wires **P**, **Q**, **R** and **S** in Setup A are to be connected to the points X and Y in Setup B to form a complete circuit.

Which two wires, when connected to points X and Y, will give the highest ammeter readin



Setup A



Setup B

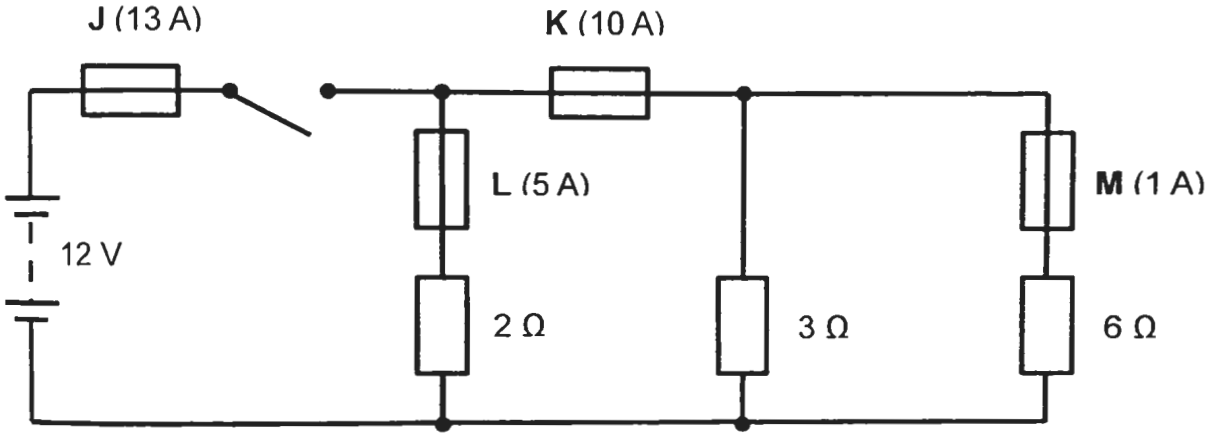
A P and Q
B P and S
C Q and R
D R and S

An electric kettle uses 12 kWh after 3 hours of operation. If the cost of energy consumption is 4 cents per kWh, what are the power consumed and the cost payable?

	power / kW	cost / cents
A	4	48
B	4	144
C	36	48
D	36	144

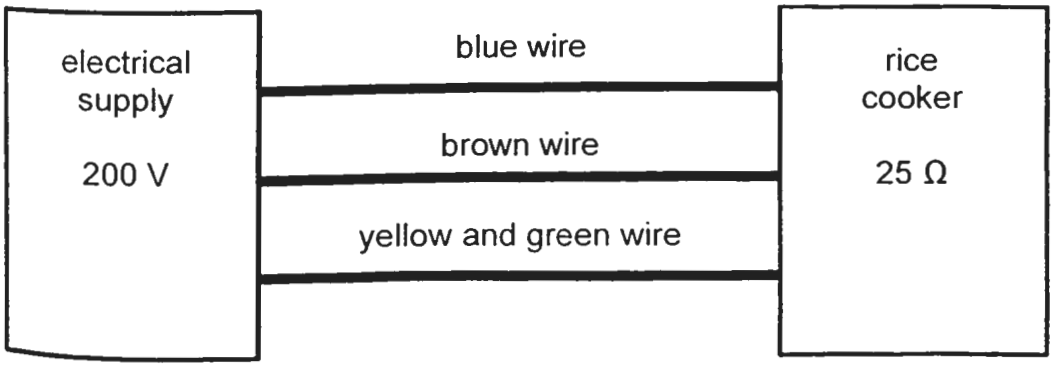
The diagram shows four fuses, **J**, **K**, **L**, and **M**, in a circuit with three resistors.

When the switch is closed, which two fuses will be blown?



A J and **K** only
B J and **M** only
C **K** and **L** only
D **L** and **M** only

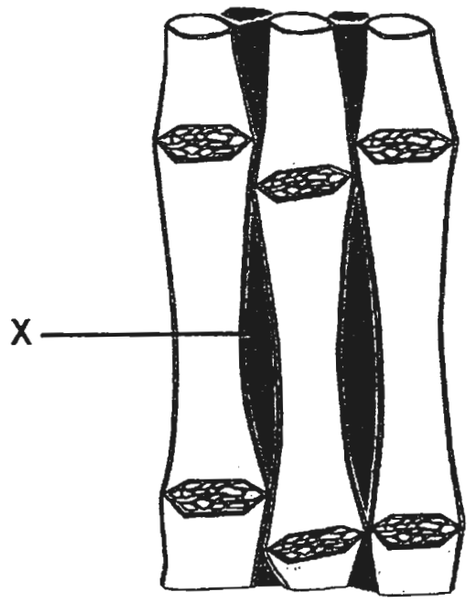
The diagram shows the three wires of an electrical supply connected to a rice cooker.



What are the currents flowing through the wires when the rice cooker is switched on and functioning properly?

	blue wire	brown wire	yellow and green wire
A	0 A	8 A	0 A
B	8 A	0 A	0 A
C	8 A	8 A	0 A
D	8 A	8 A	8 A

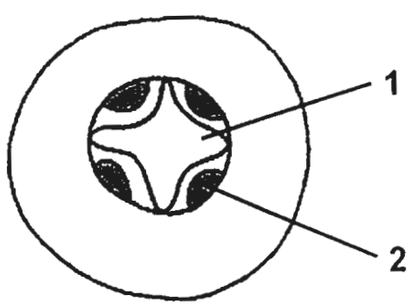
16 The diagram shows a section of the stem.



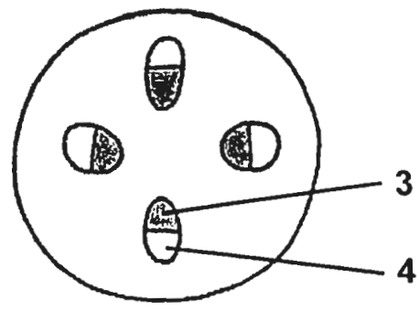
What is the function of cell **X**?

A Cell **X** matures into other vascular tissues.
B Cell **X** transports glucose and amino acids.
C Cell **X** produces energy for another cell to perform a function.
D Cell **X** transports water and dissolved mineral salts.

17 The diagram shows the sections of a root and a stem of a plant.



section of root

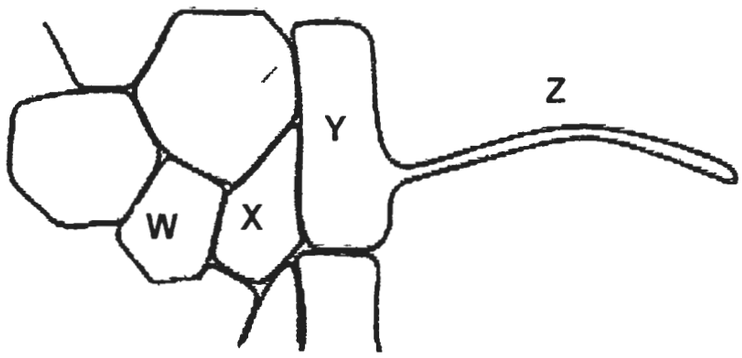


section of stem

Where are the xylem and phloem located?

	xylem	phloem
A	1 & 3	2 & 4
B	1 & 4	2 & 3
C	2 & 3	1 & 4
D	2 & 4	1 & 3

18 The diagram shows three plant root cells (**W**, **X**, **Y**) and the soil solution (**Z**).



Which statement is correct?

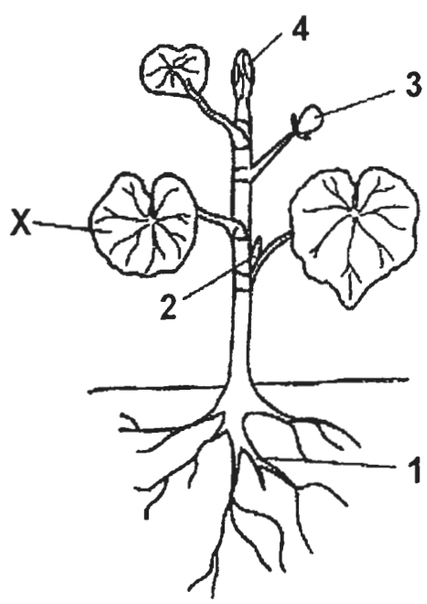
A The water potential of the water found in soil **Z** is zero.
B The water potential of cell sap in **X** is lower than cell **W**.
C The water potential of cell sap in **X** is higher than cell **Y**.
D The water potential of cell sap in **W** is the lowest of the three cells.

19 Which of the following statement(s) describe why transpiration is useful for the plants?

1 Transpiration cools the plant down by removing latent heat of vaporisation.
2 Transpiration allows excess water to escape so that plant cells will not burst.
3 Transpiration helps to transport dissolved mineral salts and water up the plant.

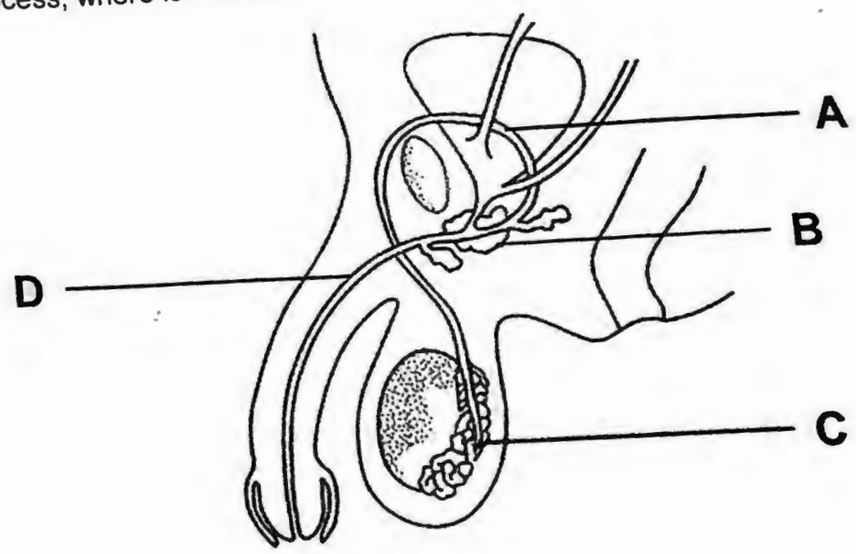
A 1 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

20 Where is the manufactured food made by leaf **X** likely be translocated to?

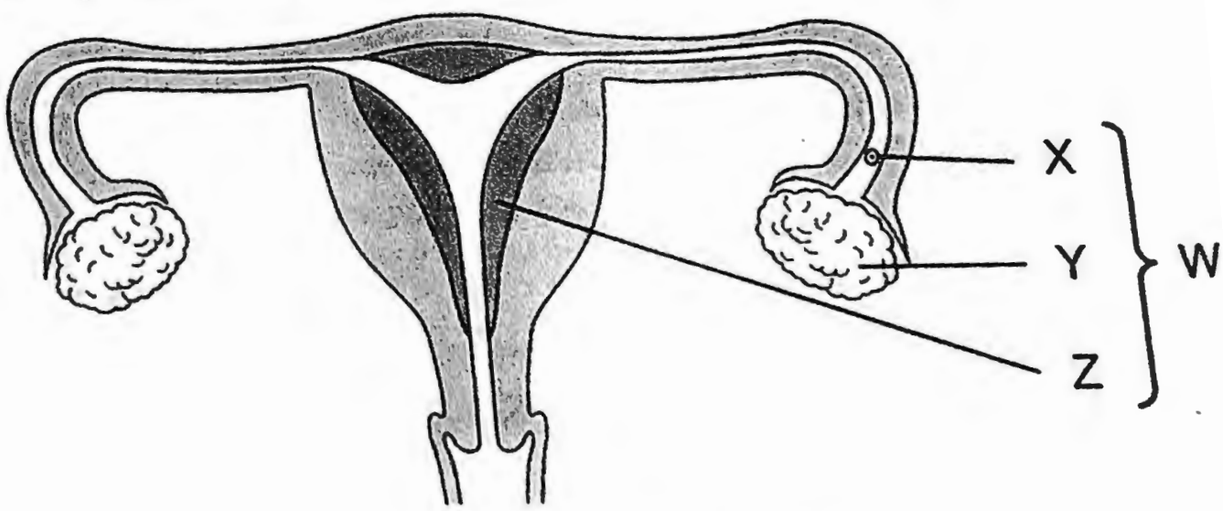


A 1 and 2 only
B 3 and 4 only
C 2, 3 and 4 only
D 1, 2, 3 and 4

21 The diagram shows the male reproductive system and part of the urinary system. During the ejaculatory process, where is semen found in?



22 The diagram shows the female reproductive system.



Which level of organisation are the structures **W**, **X**, **Y** and **Z**?

	cell	tissue	organ	organ sys
A	W	Y	X	Z
B	X	Z	Y	W
C	Y	X	Z	W
D	Z	W	Y	X

23 Which statement is true about a woman's fertile period?

A Her fertile period starts a few days before ovulation as sperms are able to su a few days.

B Her fertile period starts a few days before ovulation as the ovum released fr previous cycle will still be intact.

C Her fertile period starts immediately after menstruation has taken place as ovum will start to develop.

D Her fertile period starts only after ovulation has taken place as an ovum ha present for fertilisation to take place.

24 What is the most important function of the amniotic fluid during pregnancy?

A It allows space for the growth of the fetus.
B It enables the fetus to get rid of waste products.
C It protects the fetus from mechanical shock.
D It provides nourishment for the growth of the fetus.

25 How does the HIV result in the symptoms of AIDS?

A It weakens the human immune system by killing white blood cells.
B It destroys antibodies required to protect the body from foreign pathogens.
C It directly causes multiple diseases and cancers such as Kaposi's sarcoma.
D It renders the body vulnerable against diseases by destroying red blood cells.

– End of Section A –

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Name: _____( ) Class: _____

Section B – CHEMISTRY (10 marks)

*Answer **ALL** questions in the spaces provided.*

B1 Razz berry, an exotic fruit, is found to have therapeutic effects on injured animals. It is found that the active ingredient in Razz berry is a magnesium compound, $MgZb_2$, where Zb is a non-metal element of unknown identity.

(a) An isotope of magnesium has an atomic mass of 26. Write the nuclide notation for this isotope. [1]

Nuclide notation: .....

(b) Based on the information given, which Group of the periodic table is Zb likely to be placed? [1]

.....

(c) $MgZb_2$ can be synthesised through a neutralisation reaction.

(i) Complete the equation below by writing the chemical formula of the missing reactant. [1]

2 ..... + $Mg(OH)_2$ → $MgZb_2$ + 2 H_2O

(ii) Draw a dot-cross diagram to show the bonding in $MgZb_2$. [2]
(Only valence electrons need to be shown.)

(iii) Assuming that $MgZb_2$ is soluble in water, explain whether the products of the neutralisation reaction can conduct electricity. [1]

.....

.....

Total: 6 marks

B2 Copper(II) carbonate powder, when heated strongly over the Bunsen burner, decomposes to form copper(II) oxide powder and carbon dioxide.

(a) Write the chemical equation, with state symbols, for the decomposition of copper(II) carbonate by heat. [2]

.....

(b) Both copper(II) carbonate and copper(II) oxide react with sulfuric acid when placed into separate beakers containing the acid.

(i) Name the product(s) which can be found in both reactions. [1]

.....

(ii) State a difference in the observation for reactions in the 2 beakers. [1]

.....

.....

Total: 4 marks

– End of Section B –

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Name: _____ ( ) **Class:** _____

Section C – PHYSICS (15 marks + 2 bonus marks)

*Answer **ALL** questions in the spaces provided. Question marked with a * is optional.*

C1 The archer fish has a unique way of catching its prey. It shoots a jet of water upwards to knock off insects from low branches as shown in Fig. C1.1. The prey falls into the water and is eaten by the archer fish.

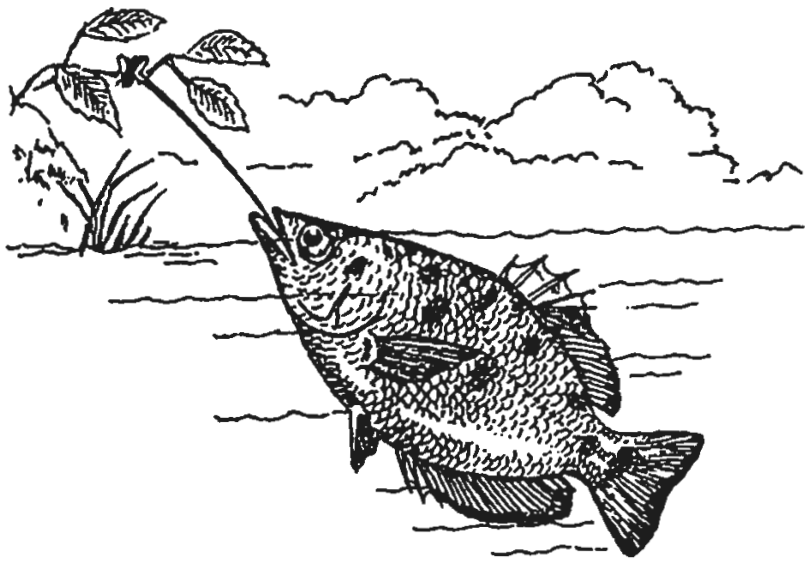

Fig. C1.1

(a) From the point labelled "+" (the position of the insect), draw 2 light rays entering the fish's eye in Fig. C1.2. [2]

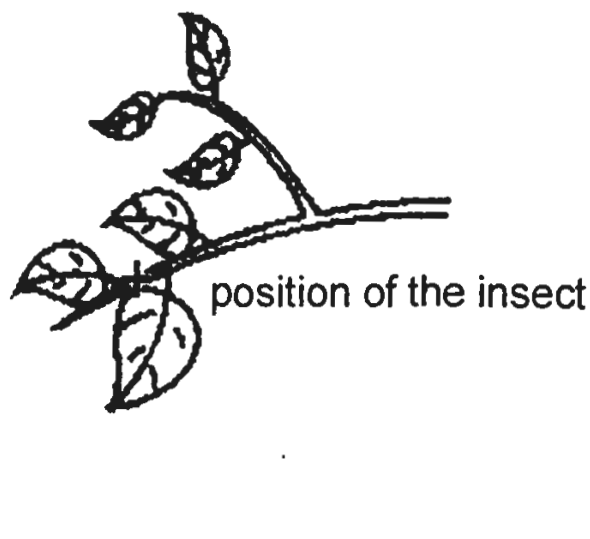

Fig. C1.2

(b) By appropriate extension of the rays, determine where the insect will appear to the fish. Label the position of the image with an '**I**'. [1]

(c) Explain why the fish prefers to shoot its prey from a position directly underneath it. [1]

.....

Total: 4 marks

C2 Fig. C2.1 shows an object **O** and its image **I** produced by a lens **L** (not shown).

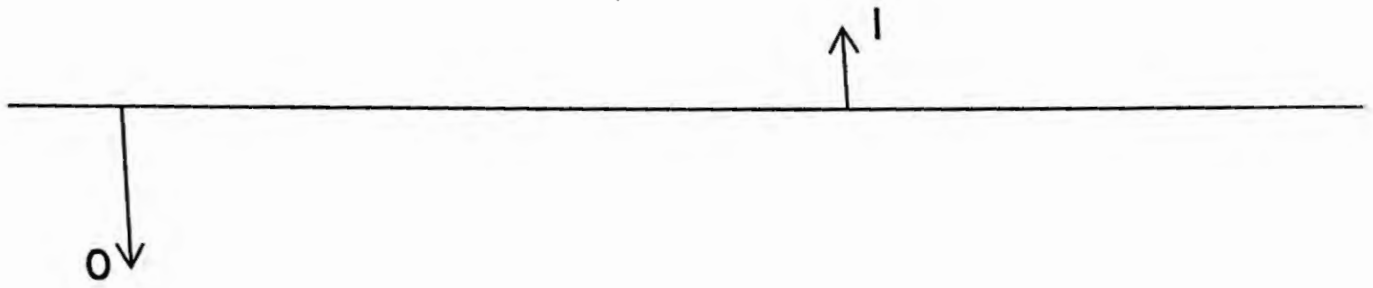

Fig. C2.1

(a) Draw two light rays on Fig. C2.1 to show how the image is formed. [3]

Label the lens as '**L**' and the position of the principal focus as '**F**'.

(b) State one application that makes use of such a lens arrangement. [1]

.....

Total: 4 marks

C3 (a) State a difference between potential difference and electromotive force. [1]

.....

.....

.....

.....

(b) In a household circuit, the switch is always connected to the live wire of an electrical appliance. Explain why this is safer than connecting the switch to the neutral wire. [1]

.....

.....

.....

.....

(c) A microwave oven is rated 220-240V, 1500 W. Calculate the minimum resistance of the heating element in the microwave oven. [2]

Total: 4 marks

C4 **(a)** Fig. C4.1 shows nine resistors **A** to **I** connected in a circuit.

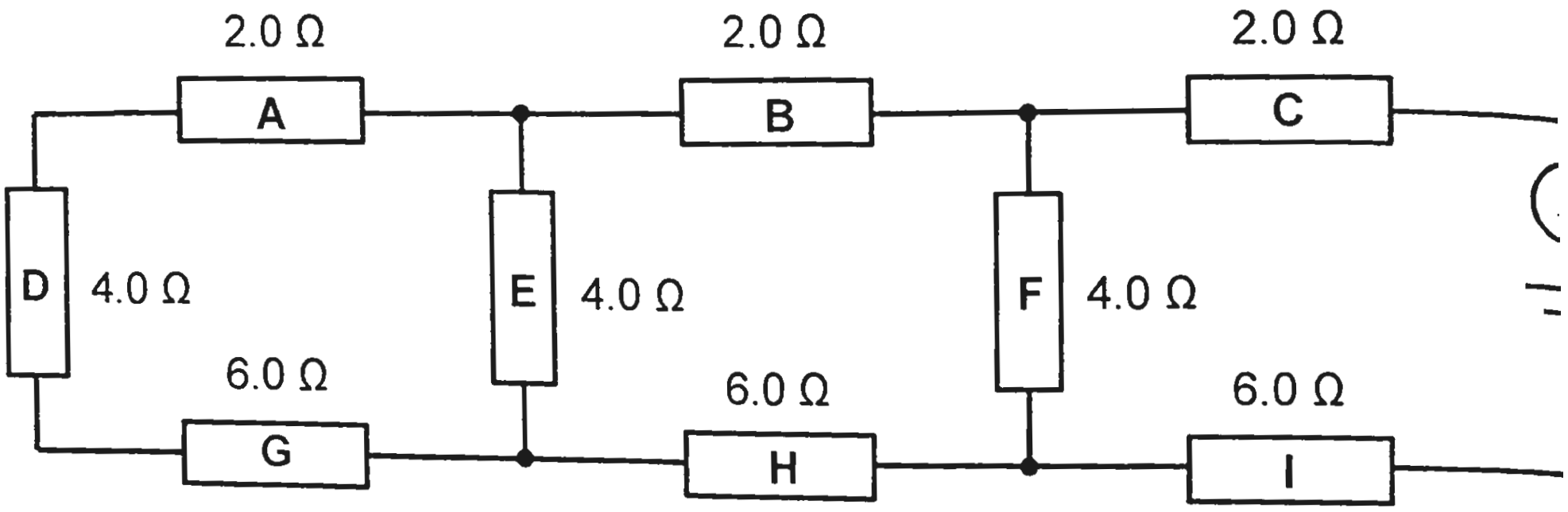

Fig. C4.1

(i) Show that the effective resistance across resistors **A**, **B**, **D**, **E**, **F**, **G**, and **H** is 2.9 Ω. [2]

(ii) Hence, calculate the effective resistance of the whole circuit. [1]

* **(b)** The ammeter reads 3.0 A. Calculate the current across resistor **E**. [2]

Total: 3 + 2 bonus marks

* This is an optional question. You may choose not to answer this question. Marks scored for this question will be added to the total score but the maximum score for this exam remains at 75 marks

– End of Section C –

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Name: _____ ( ) Class: _____

Section D – BIOLOGY (25 marks + 2 bonus marks)

*Answer **ALL** questions in the spaces provided. Question marked with a * is optional.*

D1 Fig. D1.1 and D1.2 show the leaf cross sections of two different plants, **A** and **B** respectively.

Plant A

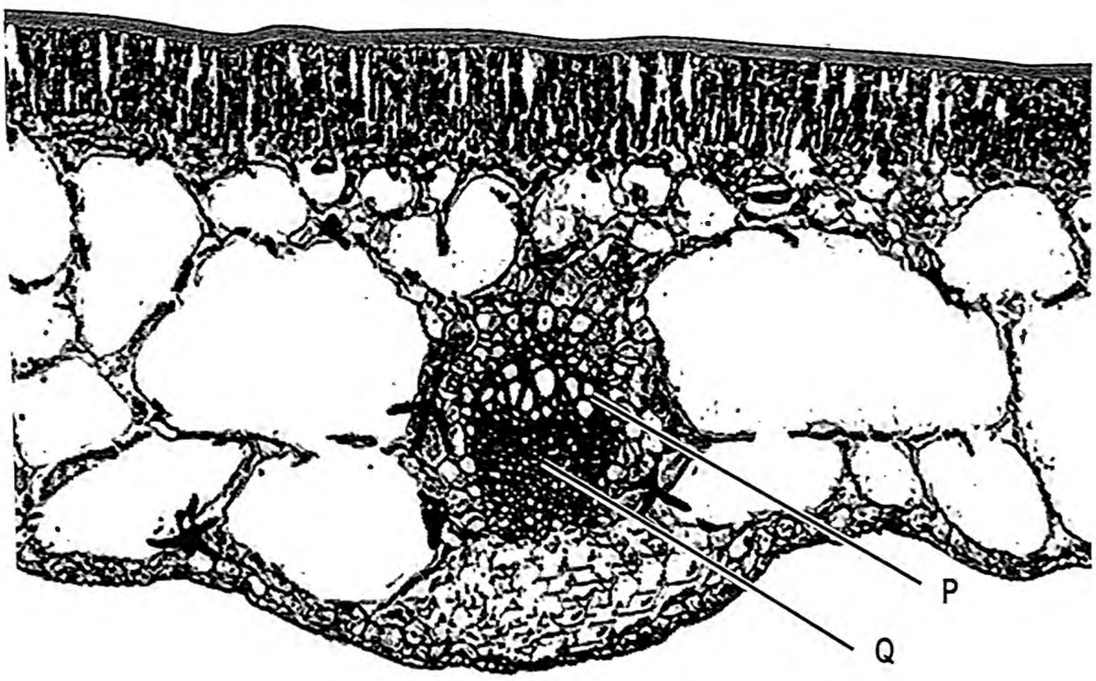

Fig. D1.1

Plant B

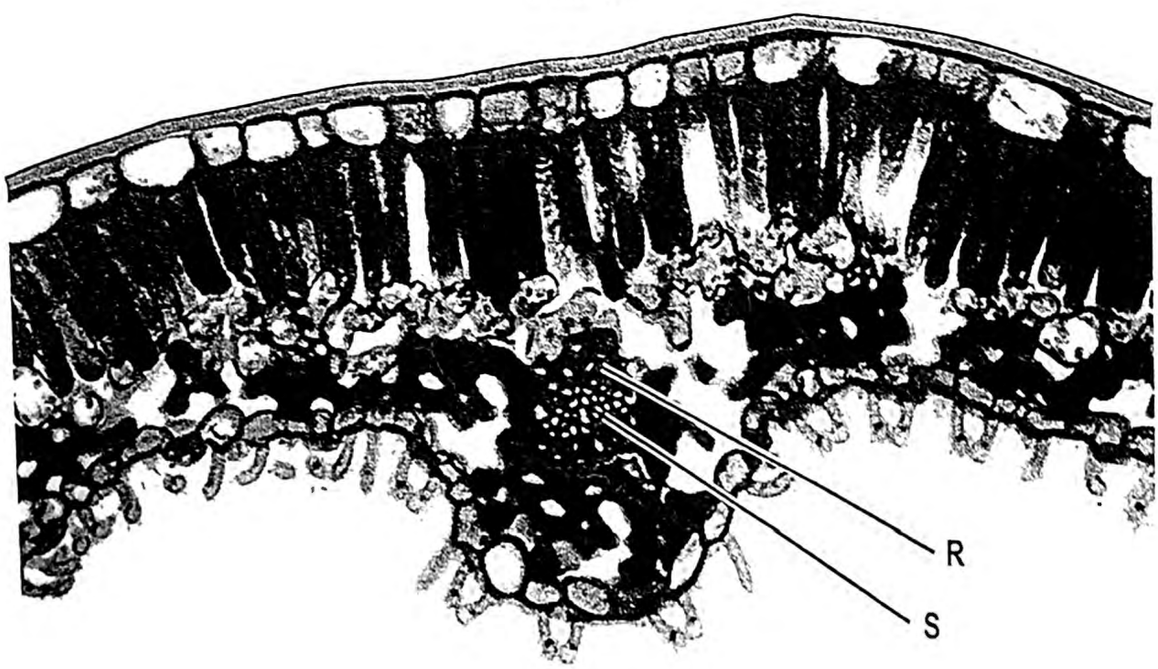

Fig. D1.2

(a) Name the vascular tissue that is responsible for transporting water up to the leaves. [1]

.....

(b) State which label(s) **P**, **Q**, **R** and **S**, indicate(s) the tissue specified in (a). [1]

.....

(c) State which plant, **A** or **B**, is more likely found in a dry environment. [1]

.....

(d) Describe and explain one observable feature of the plant you have named in (c) that helps it to adapt to the dry environment. [2]

.....

.....

.....

.....

Total: 5 marks

D2 Farmers have been known to partially damage the stem of plants that have just fruited by 'ringing' to increase the size of these fruits. 'Ringing' in this situation involves removing a few outer layers around the stem of the fruit tree, including about two thirds of a layer of living tissue. This disrupts the movement of manufactured food substances in the plant.

(a) State the tissue layer(s) that is/are removed by 'ringing'. [1]

.....

(b) Suggest how 'ringing' helps to increase the size of the fruits that develop. [2]

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.....

.....

.....

(c) Explain why the farmers only remove about two thirds of the layer of living tissue during 'ringing'.

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Total: 5 ma

D3 Fig. D3.1 shows changes in the uterus during the menstrual cycle.

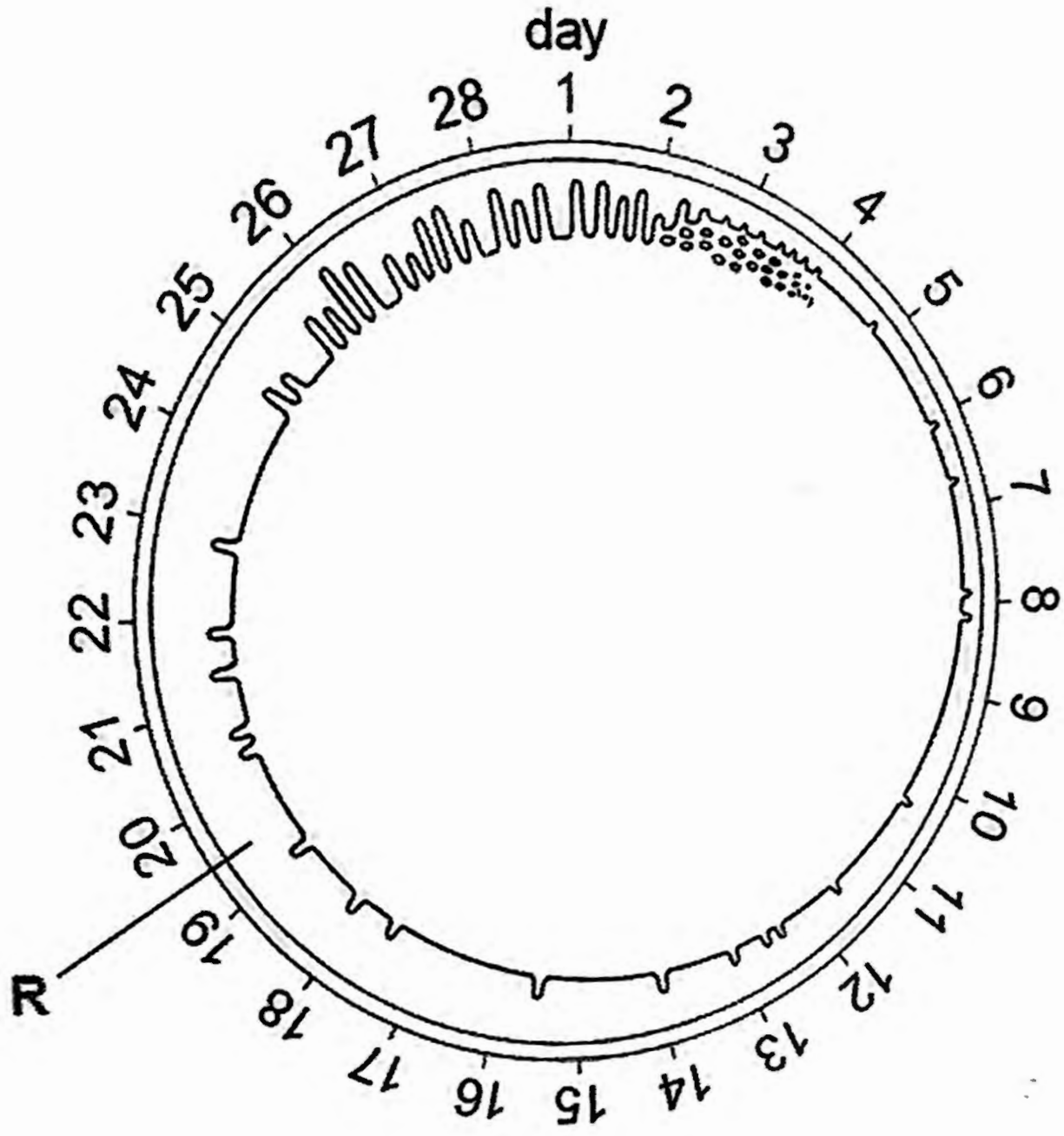

Fig. D3.1

(a) Identify **R**. ..... [1]

(b) Ovulation occurs on day 14 of the menstrual cycle. *Gardnerella vaginalis* is a bacteria found in reproductive tracts, particularly in women. Infection by *G. vaginalis* leads to damage of the inner surface of the oviducts.

Describe how this infection affects the ovum after ovulation. [2]

.....

.....

.....

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.....

(c) After ovulation, the follicle that released the ovum begins producing hormones.

(i) Name the main hormone that is produced. [1]

.....

(ii) With reference to Fig. D3.1, describe the effect(s) of this hormone. [2]

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Total: 6 marks

D4 Fig. D4.1 shows some stages in human reproduction.

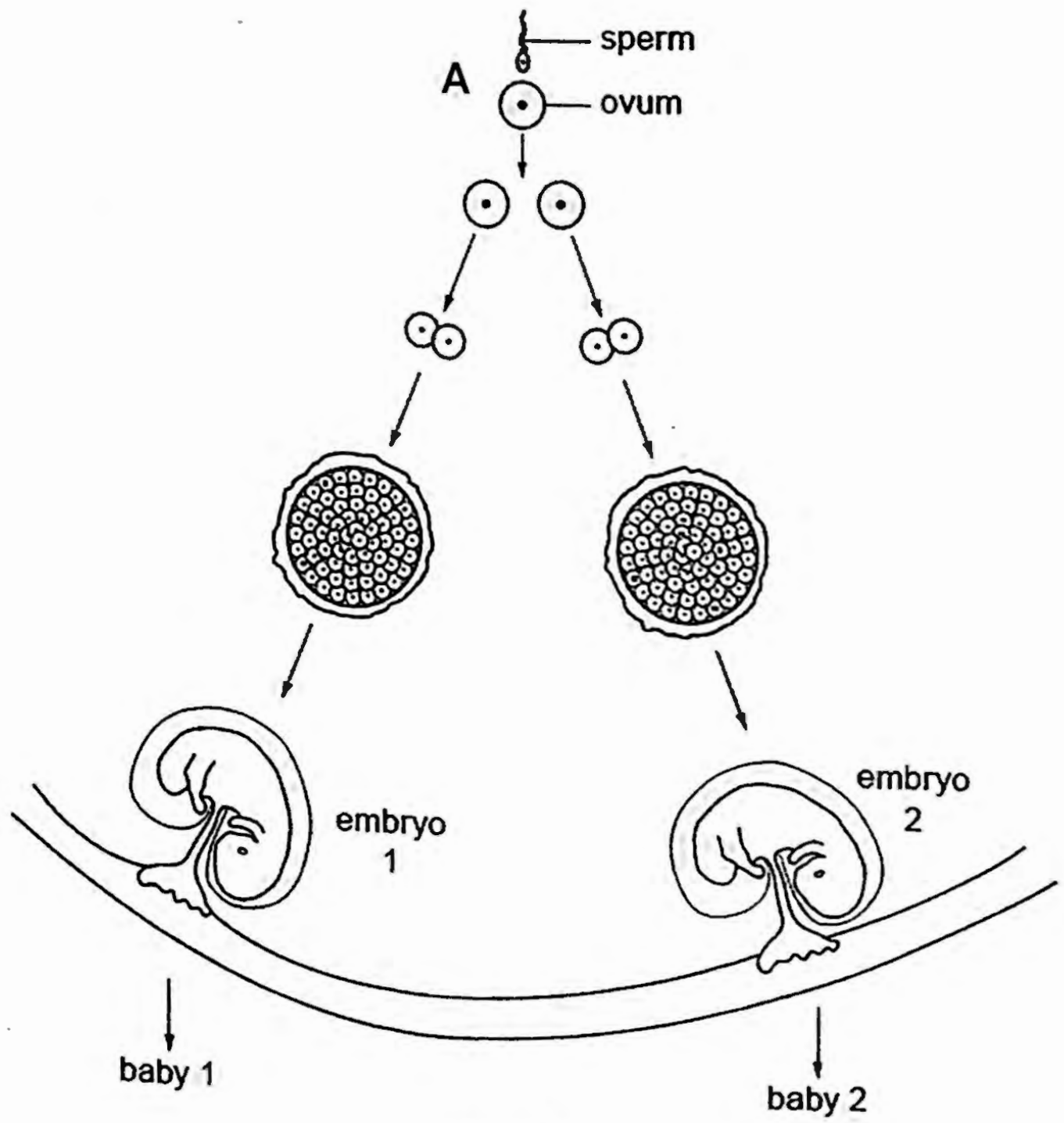

Fig. D4.1

(a) Name the process that is about to occur at **A** and state where in the reproductive system it normally occurs. [1]

process .....

where it occurs .....

(b) Describe briefly how two **named** substances are passed from mother to fetus. [2]

.....

.....

.....

.....

(c) Suggest and explain why blood must not pass directly from mother to fetus during pregnancy, even though it contains substances necessary for fetal development. [2]

.....

.....

.....

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(d) Following the birth of twins, Mr and Mrs Ang decided not to have any more children in their lifetime.

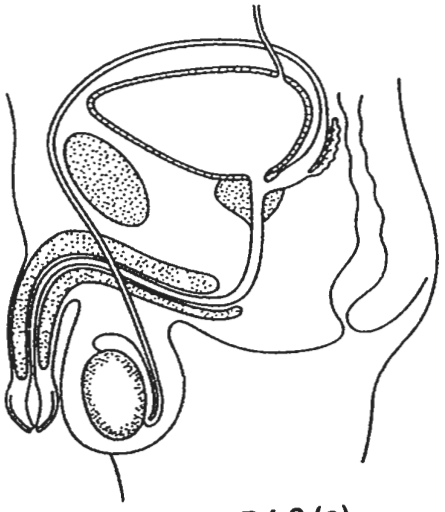

Fig. D4.2 (a)

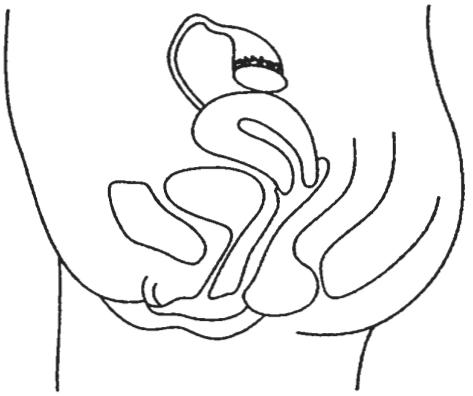

Fig. D4.2 (b)

Draw a line across the relevant parts in Fig. D4.2 (a) and Fig. D4.2 (b) respectively, to indicate where a cut can be made in order to carry out a form of surgical contraception. [2]

(e) Zika virus is transmitted to people primarily through the bite of an infected *Aedes* mosquito. Once infected, a person may transmit the virus to another individual through sexual intercourse. The virus may cause microcephaly in the fetus of pregnant women. Microcephaly is a medical condition in which the brain does not develop properly resulting in smaller than normal head.

Zika virus is prevalent in Brazil. Mr Ang is worried he might have contracted Zika virus after visiting Brazil for the Olympics. Mrs Ang, apprehensive of being infected, refuses sexual intercourse with him. Mr Ang tries to convince his wife that both their surgical contraceptions make transmission very unlikely. He will further reduce the likelihood of transmission by using a condom during intercourse.

Discuss whether you think that the two precautions stated by Mr Ang are effective in preventing sexual transmission of the Zika virus. [2]

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Total: 9 marks

D5 * In-vitro fertilisation (IVF) is a procedure whereby the mature ovum is removed from the ovary of a woman, mixed with a man's semen on a Petri dish to allow for fertilisation, and the blastocyst is placed back into the woman's uterus. [2]

Explain how IVF is able to overcome a **specific** infertility problem of a couple who wishes to have children. Assume that the ovum and sperm are only obtained from the couple and not from a third party donor.

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Total: 2 bonus marks

* This is an optional question. You may choose not to answer this question. Marks scored for this question will be added to the total score but the maximum score for this exam remains at 75 marks

– End of Section D –