OCR
Oxford Cambridge and RSA

Thursday 5 June 2025 – Afternoon

A Level Biology B (Advancing Biology)

H422/01 Fundamentals of biology

Time allowed: 2 hours 15 minutes

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **110**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **44** pages.

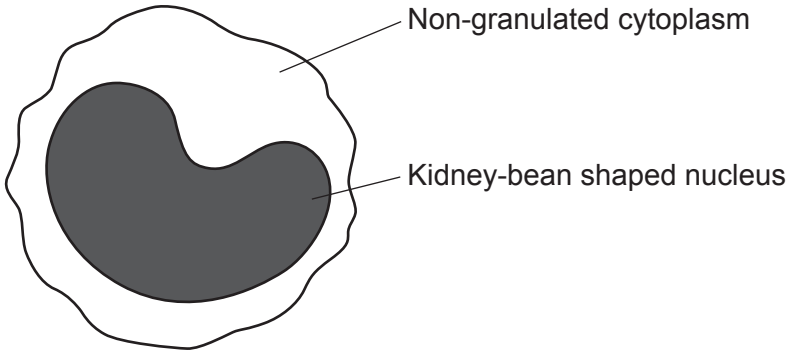
ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **40 minutes** on this section.

Write your answer for each question in the box provided.

1 Which type of blood cell is shown in the annotated drawing?



A Erythrocyte

B Lymphocyte

C Monocyte

D Neutrophil

Your answer C **[1]**

2 Which technique uses fluorescent markers to tag cells so they can be counted and identified when passed through a laser beam?

A Differential staining

B Flow cytometry

C Gel electrophoresis

D Haemocytometry

Your answer B **[1]**

3 Which statement about ATP is **not** correct?

A It can be hydrolysed to form AMP.

B It contains the pentose sugar, ribose.

C It contains the pyrimidine nitrogenous base, adenine.

D It is a phosphorylated nucleotide.

Your answer C **[1]**

4 The percentage base composition of DNA from a species of octopus is shown in the table.

Base	**Adenine**	**X**	**Y**	**Z**
% base composition of DNA	33.2	17.6	17.5	31.7

Which option correctly identifies bases **X**, **Y** and **Z**?

A Base **X** is cytosine, **Y** is guanine and **Z** is thymine.

B Base **X** is cytosine, **Y** is guanine and **Z** is uracil.

C Base **X** is thymine, **Y** is cytosine and **Z** is guanine.

D Base **X** is uracil, **Y** is cytosine and **Z** is guanine.

Your answer A **[1]**

5 A student calculated cardiac output (CO) using the equation:

CO = heart rate × stroke volume.

What unit of measurement is appropriate for cardiac output?

A $bpm\,cm^{-3}$

B $cm^{3}\,bpm$

C $dm^{-3}\,min^{-1}$

D $dm^{3}\,min^{-1}$

Your answer D **[1]**

6 Which of the following statements about the advantages of a closed circulatory system is/are correct?

1 Deoxygenated and oxygenated blood are separated.

2 Higher blood pressure is maintained in both pulmonary and systemic circuits.

3 Low blood volumes can maintain movement in the circulatory system.

A 1, 2 and 3 are correct

B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer B **[1]**

7 Alveoli are structures found in the mammalian gaseous exchange system.

Which cells would be present in the walls of alveoli?

A Ciliated epithelial cells

B Goblet cells

C Muscle cells

D Squamous epithelial cells

Your answer D **[1]**

8 The surface area provided by a single alveolus is approximately 300 000 μm^2.

A person was estimated to have 250 million alveoli in each lung.

What is the estimated gas exchange surface area in m^2 for this person?

A 7.5×10^1

B 1.5×10^2

C 7.5×10^7

D 1.5×10^8

Number of Alveoli $= 2 \times 250 \times 10^6 = 5 \times 10^8$

Total surface area $= 5 \times 10^8 \times 3 \times 10^5$

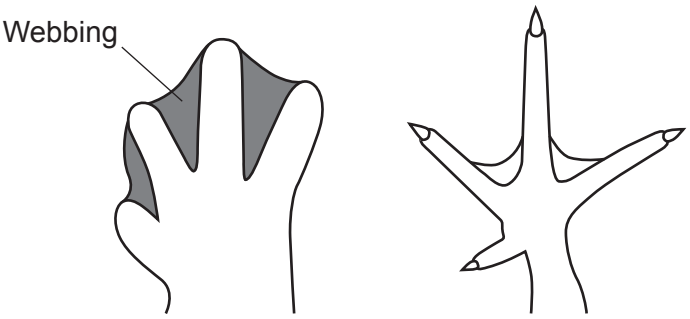
$= 15 \times 10^{13} \mu m^2$

$= \frac{15 \times 10^{13} \mu m^2}{1 \times 10^{12} \mu m^2/m^2} = 15 \times 10^{(13-12)}$

$= 150 m^2$

Your answer B **[1]**

9 The diagram shows the feet of a chicken embryo and an adult chicken.



What process ensures that webbing between the toes of the chicken is removed during development?

A Apoptosis

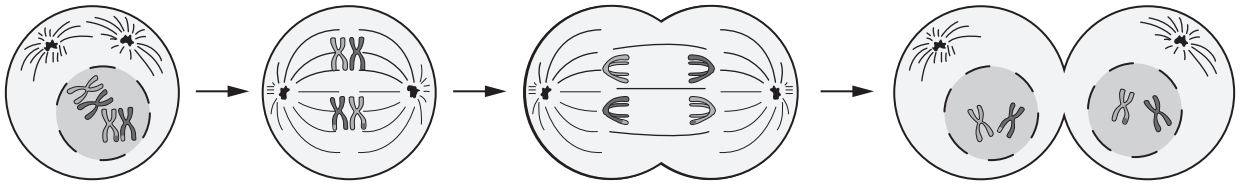
B Cytokinesis

C Differentiation

D Mitosis

Your answer A **[1]**

10 The diagram shows four consecutive phases of meiosis in an animal cell.



Phase 1 Phase 2 Phase 3 Phase 4

Which of the following statements is/are correct?

1 The cell is undergoing the first meiotic division.

2 Chiasmata formation starts taking place during phase 2.

3 Independent assortment of chromosomes is taking place during phase 1.

A 1, 2 and 3 are correct

B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer D **[1]**

11 Evolutionary relationships between species can be shown using phylogenetic trees.

Which statement about phylogenetic trees is correct?

A Branches for extant species end before the present day.

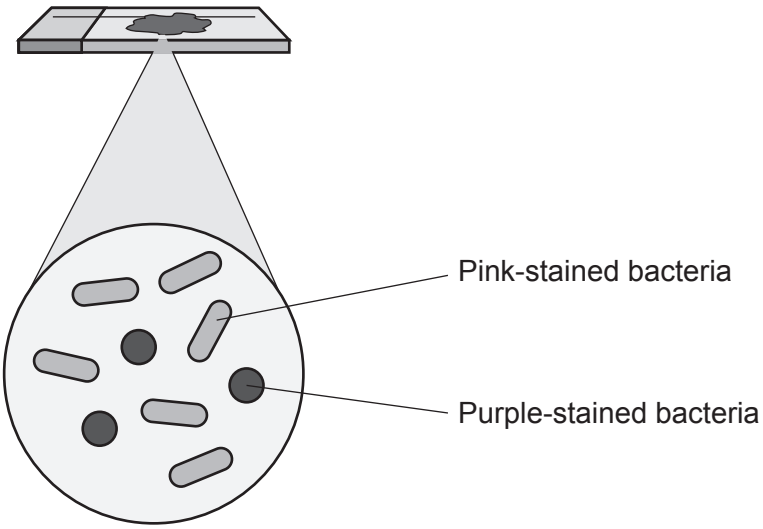
B Nodes at branching points represent common ancestors.

C Species with the most recent common ancestors have more distant evolutionary relationships.

D They cannot be constructed from fossil evidence.

Your answer B **[1]**

12 The diagram shows bacterial colonies after Gram-staining procedure.



Which statement about the Gram-staining procedure is correct?

A The purple-stained bacteria are Gram positive as the safranin counterstain bound to their thick cell walls.

B The purple-stained bacteria are Gram negative as crystal violet-iodine stain bound to their thick cell walls.

C The pink-stained bacteria are Gram positive as safranin counterstain bound to their thin cell walls.

D The pink-stained bacteria are Gram negative as safranin counterstain bound to their thin cell walls.

Your answer D **[1]**

13 Amoxicillin is an antibiotic that can be used to treat bacterial infections in young children.

A one-year-old child with a mass of 10 kg requires 40 mg kg^{-1} of amoxicillin per day to treat an ear infection.

The amoxicillin is provided in a suspension of 400 mg per 5 cm^3 and is given to the child in twice daily doses.

What is the correct dose of amoxicillin given to the child?

A 0.25 cm^3

B 0.50 cm^3

C 2.50 cm^3

D 5.00 cm^3

$\frac{400mg}{5cm^3} : \frac{200mg}{x}$

$x = 2.50cm^3$

Your answer C **[1]**

14 A patient is undergoing treatment for a brain tumour. The treatment accurately targeted and destroyed the actively growing cells in the tumour by damaging their DNA.

What therapy is used to treat the patient's brain tumour?

A Chemotherapy

B Hormone-related therapy

C Immunotherapy

D Radiotherapy

Your answer D **[1]**

15 Which disease is **not** an example of a chronic condition?

A Asthma attack

B Bowel cancer

C Emphysema

D Lung cancer

Your answer A **[1]**

16 Which molecule is used to donate electrons to the electron transport chain during oxidative phosphorylation?

A ADP

B ATP

C Reduced NAD

D Reduced NADP

Your answer C **[1]**

17 An athlete used carbohydrate loading prior to a race to enhance their performance.

The athlete has a body mass of 75 kg and consumed 1100 g of carbohydrates over two days prior to the race.

What mass of carbohydrates was consumed each day per kg of body mass?

A 7.3 g

B 14.7 g

C 68.2 g

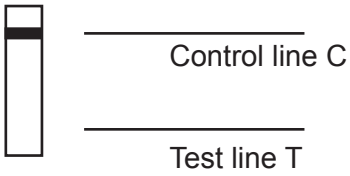
D 136.4 g

Daily consumption $= \frac{1100}{2} = 550\ g/day$

Daily consumption per kg $= \frac{550g}{75Kg} \simeq 7.33\ g/kg$

Your answer A **[1]**

18 The diagram shows the result of a pregnancy test. The test was carried out using a pregnancy testing kit containing monoclonal antibodies.



Which of the following statements is/are correct?

1 A negative result is shown by this pregnancy test.

2 At test line T there are no antibodies with hCG attached to bind to the immobilised antibodies.

3 At control line C antibodies with hCG attached bind to the immobilised antibodies.

A 1, 2 and 3 are correct

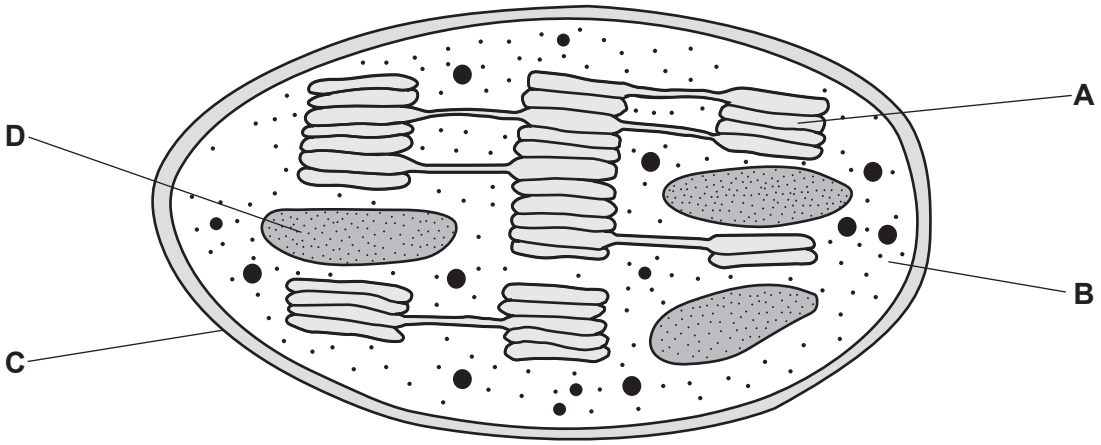
B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer B **[1]**

19 The diagram shows the ultrastructure of a chloroplast.



What is the site of light-independent reactions?

Your answer B **[1]**

20 A student uses paper chromatography to separate a mixture of photosynthetic pigments.

The student allows the solvent to run 6.5 cm up the paper.

They measure the distance travelled by carotene pigment and calculate the R_f value of carotene as 0.95.

What is the distance measured by the student to the nearest mm for carotene?

A 6

B 7

C 62

D 68

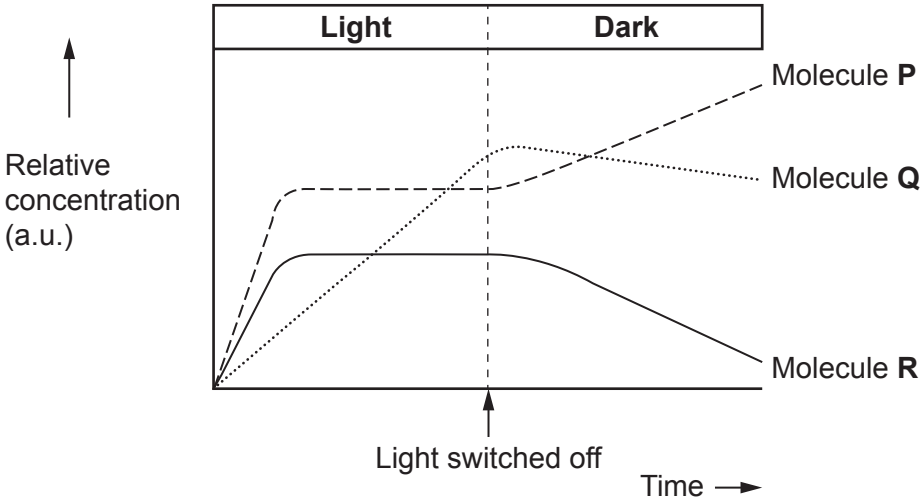
Your answer C **[1]**

Distance measured by the Student
= Rf x Distance travelled by solvent front
= 0.95 x 6.5
= 6.175 cm
= 6.175 cm x 10mm/cm
= 61.75 mm

21 The diagram shows the results of an investigation into the effect of periods of light and dark on photosynthesising cells.

The relative concentrations are shown for glucose, glycerate-3-phosphate (GP) and ribulose bisphosphate (RuBP) over time.

These have been labelled on the diagram as molecules **P**, **Q** and **R**.



The table shows possible identities for molecules **P**, **Q** and **R**.

	Molecule **P**	Molecule **Q**	Molecule **R**
A	glucose	GP	RuBP
B	GP	RuBP	glucose
C	GP	glucose	RuBP
D	RuBP	glucose	GP

Which row is correct?

Your answer C **[1]**

22 Which of the following factors will **not** directly affect the size of the human global population?

A Advances in medical technology

B Control of communicable disease

C Food security

D Immigration

Your answer D **[1]**

23 A group of students were investigating the effect of temperature on the germination of cress seeds.

Ten cress seeds were placed in a Petri-dish containing wet cotton wool. The Petri-dish was then placed in an incubator at 5 °C and observed for signs of germination.

This procedure was repeated for incubation temperatures of 10, 15, 20 and 25 °C.

What is the most appropriate dependent variable for this investigation?

A Number of seeds germinating in 48 hours.

B Temperature of each incubator.

C Time taken for all ten seeds to germinate.

D Volume of water used to soak the cotton wool in each Petri-dish.

Your answer A **[1]**

24 A sequence of nucleotide bases in a DNA coding strand is shown below.

TCA-TGG-CTG-GGC-CTC-GCC-TCC

Which of the following statements is/are correct?

1 A substitution mutation of A would result in a change to subsequent triplet codes.

2 A substitution mutation of A could result in the same sequence of amino acids.

3 A deletion mutation of A will result in frameshift change to the sequence.

A 1, 2 and 3 are correct

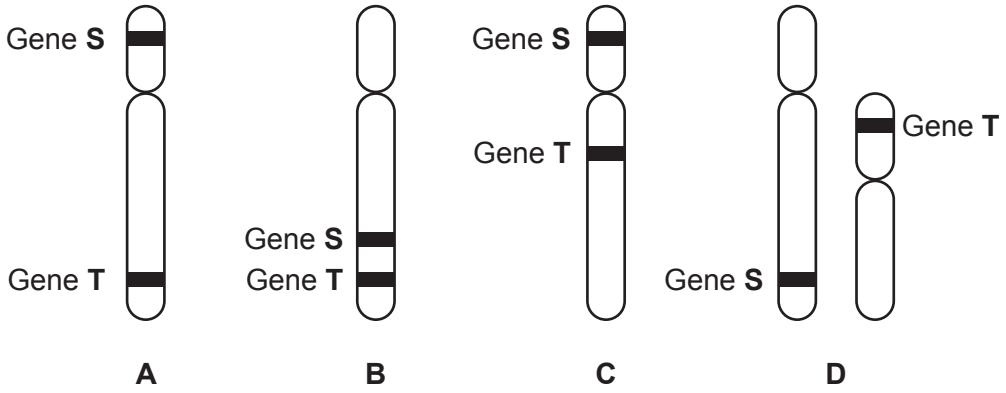
B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer C **[1]**

25 The diagrams of chromosomes show the positions of genes **S** and **T**.



Which of the diagrams shows autosomal linkage of genes **S** and **T** that would be most likely to result in them being inherited together?

Your answer B **[1]**

26 Cicadas are large insects. Two species of cicada live in the same habitat. Members of the two species are capable of interbreeding.

- The breeding season of one species occurs every 13 years.
- The breeding season of the other species occurs every 17 years.

Which of the following statements is/are correct?

1 The two species are reproductively isolated.

2 The two species are geographically isolated.

3 The cicadas are actually two populations because they can still interbreed.

A 1, 2 and 3 are correct

B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer D **[1]**

27 The Hardy-Weinberg principle uses the two equations below.

$p + q = 1.0$

$p^2 + 2pq + q^2 = 1.0$

Which statement about the Hardy-Weinberg equations is correct?

A p is the frequency of the recessive allele.

B p^2 is the frequency of the dominant allele.

C q^2 is the frequency of the homozygous recessive phenotype.

D q^2 is the frequency of the homozygous recessive genotype.

Your answer D **[1]**

28 The retina is a light-sensitive layer in the eye.

Which option describes a feature of the retina?

A It has cone cells that contain vesicles of the light-sensitive pigment, rhodopsin.

B It has highly pigmented cells to prevent internal reflection.

C It has photoreceptor cells that convert light energy to chemical energy.

D It has rod cells to allow colour vision.

Your answer C **[1]**

29 Which statement about the methods of measuring core body temperature is correct?

A Axillary measurements are most accurate because the thermometer placed under the armpit is close to the blood supply of the thermoregulatory system.

B Axillary measurements are always much higher than actual core body temperature.

C Oral measurements are most accurate because the thermometer is placed under the tongue.

D Tympanic measurements are most accurate because the thermometer is placed near the eardrum which shares a blood supply with the thermoregulatory system.

Your answer D **[1]**

30 There are two types of diabetes mellitus, type I and type II.

Which option is true for both type I **and** type II diabetes mellitus?

A If left untreated, they result in the presence of glucose in the urine.

B They are caused by destruction of β cells in the liver.

C They are caused by reduced sensitivity of β cells to insulin.

D They are known as insulin-dependent diabetes.

Your answer A **[1]**

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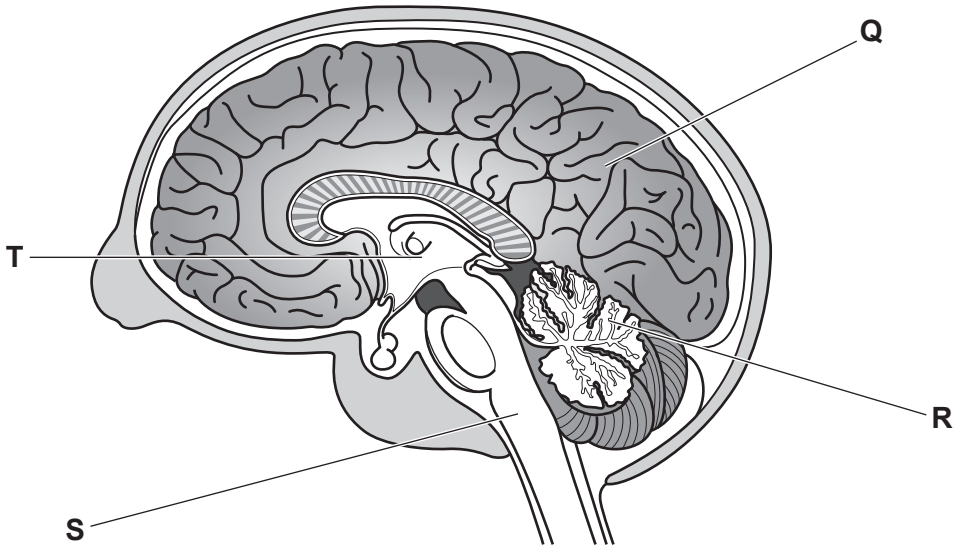
Section B

31 The human brain is divided into structures which have specific functions.

This is a diagram of a section through the human brain. Some structures of the brain have been labelled.



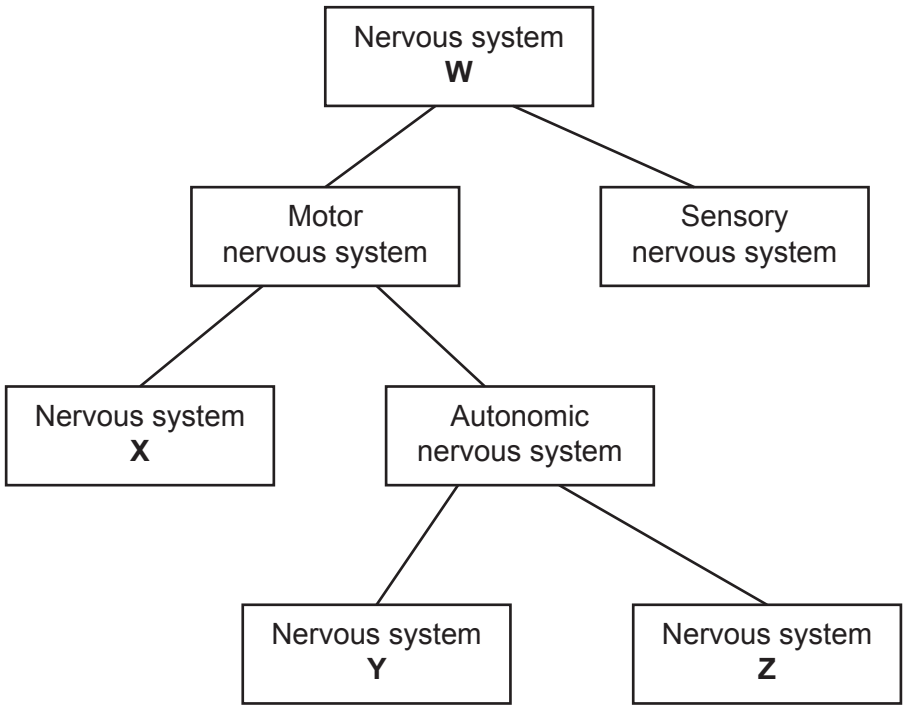
(a) Use the diagram to complete the table about some of the structures of the human brain and their functions.

Structure	Function	Letter
Cerebellum	control of muscle coordination	R
medulla	Controls activities such as heart rate and blood pressure.	S
hypothalamus	Thermoregulation	T

[3]

(b) A group of students are making revision notes about nervous control in humans.

One of the students draws the flow diagram below showing the organisation of part of the nervous system in humans.



(i) Identify nervous systems **W** and **X** in the flow diagram.

W Peripheral nervous System

X Somatic nervous System

[1]

(ii) In the autonomic nervous system, motor neurons carry impulses to smooth muscle and endocrine glands, whereas in nervous system **X** impulses are carried to skeletal muscles.

Using your knowledge, state **two other** ways in which the autonomic nervous system differs from nervous system **X**.

1 autonomic has two neurones linking CNS with effector

2 autonomic neurons are only myelinated between ganglion and CNS.

[2]

(iii) The branches of the autonomic nervous system, **Y** and **Z**, are antagonistic.

Using your knowledge and an appropriate example(s), explain how this feature helps to maintain a constant internal environment.

- negative feedback
- Y and Z are the parasympathetic and sympathetic nervous system.
- parasympathetic active during rest.
- sympathetic active is stressful

[3]

32 Mothers infected with the human immunodeficiency virus (HIV) are usually discouraged from breastfeeding as the virus can be transmitted from mother to baby during breastfeeding.

(a) Apart from breastfeeding, suggest **and** explain **one other** way in which HIV can be transmitted from an HIV-positive mother to their baby.

During Pregnancy
HIV can cross the placenta.

[2]

(b) The role of breastfeeding in providing temporary immunity against other diseases is recognised as being extremely beneficial to newborn babies.

In 2010, the World Health Organisation (WHO) issued guidelines recommending the breastfeeding of babies born to HIV-positive mothers for at least one year, using antiretroviral therapy (ART) to minimise the risk of transmission.

(i) Name the type of immunity acquired by breastfeeding.

Natural passive immunity. **[1]**

(ii) ART involves taking a combination of medicines every day. These medicines often include an inhibitor of the enzyme reverse transcriptase.

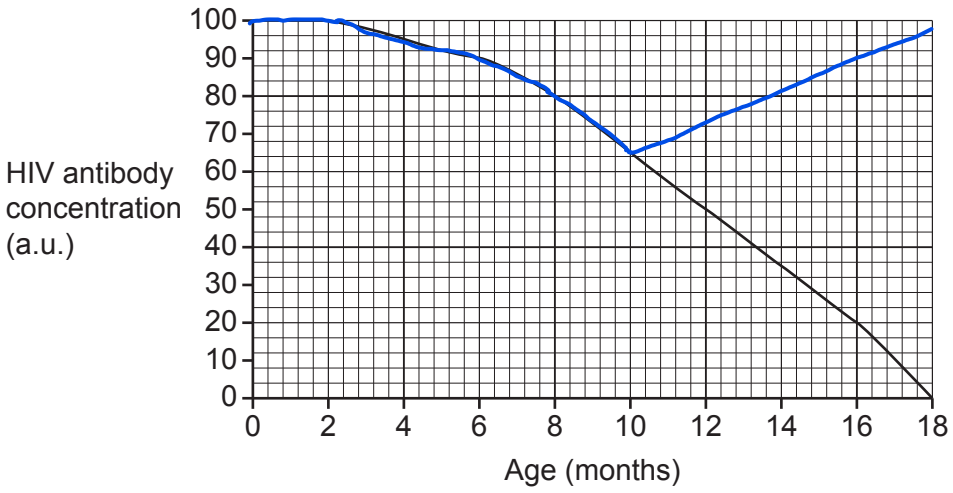
Explain how this inhibitor can minimise the risk of HIV transmission.

- HIV cannot produce viral DNA
- So viral DNA cannot be integrated into host cell
- viral proteins cannot be produced.

[2]

(c) HIV testing can be used to determine the presence of HIV.

The graph shows the results for an HIV-exposed baby who is born without HIV infection and remains uninfected throughout breastfeeding.



(i) Outline a method used to test for HIV infection.

Blood Sample

detect HIV antibodies

[2]

(ii) Calculate the mean rate of decrease in HIV antibody concentration, per day, for the first year after being exposed to HIV.

Give your answer to **2** significant figures.

$\frac{50}{365} = 0.13\,69863$

Mean rate = 0.14 a.u. per day **[2]**

(iii) Sketch a line **on the graph** to suggest the expected HIV antibody concentration for an HIV-exposed baby who is **not** infected with HIV at birth but was infected during breastfeeding at 10 months of age.

[1]

(iv) Research shows that HIV testing cannot be used to definitively diagnose infection in young babies and that babies under 18 months of age may record a false-positive test for HIV infection.

Explain why a false-positive test may be recorded in babies under 18 months of age.

Mother's HIV antibodies present in babies blood Stream.

[1]

(d)* Developing a vaccine that can prevent HIV infection in uninfected people is the highest HIV research priority given its potential for controlling and ultimately ending the HIV/AIDS pandemic.

Discuss the biological **and** ethical issues associated with the development and use of vaccines for preventing diseases such as those caused by HIV infection.

⇒ Development of vaccine biological issues.

- Changes in mutation rates of pathogens.
- Changes to antigens
- New antigens mean that antibodies already produced may no longer bind.
- new Strains of pathogen

⇒ Development of vaccine Ethical issues

- animal testing
- High cost
- time-consuming.

⇒ Use of vaccine biological issues.

- Use of live pathogens.
- Difficulties with Storage and transport
- Need for refrigeration difficult for some countries.

[6]

Extra answer space if required.

⇒ Use of vaccine Ethical issues :-

- Right to refuse
- Parental consent for Childhood vaccines
- Data protection

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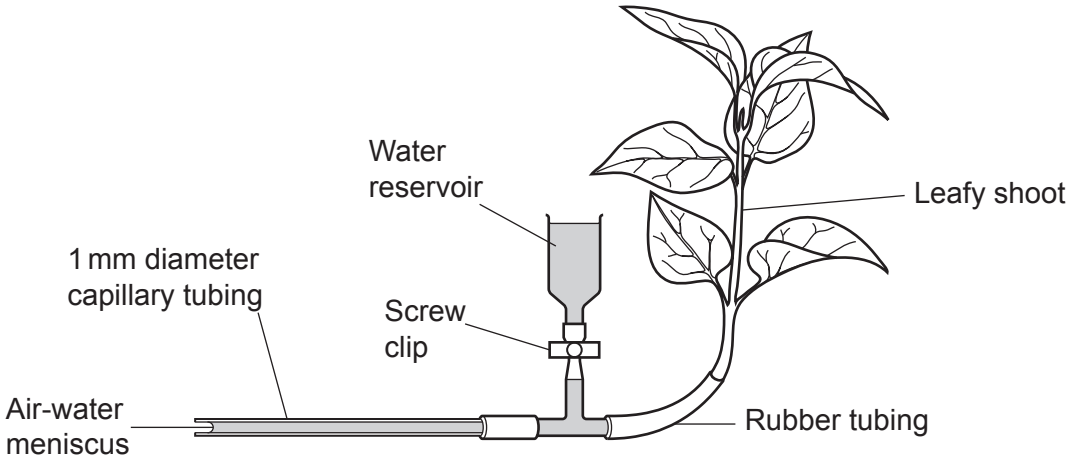
33

(a) The diagram shows the apparatus used to estimate the rate of transpiration in plants.



(i) A student wants to use the apparatus to investigate the effect of wind speed on the rate of transpiration.

Explain **two** modifications to the apparatus that will enable the student to obtain data and estimate the rate of transpiration in their investigation.

1 fan at set distance with ability to change speed.

2 rulex to measure distance moved by meniscus.

[2]

(ii) This is the raw data recorded by the student.

Results after 30 minutes			
20 cm	1) 15 mm Mean = 15.0	2) 16 mm	3) 14 mm
40 cm	1) 13 mm Mean = 13.0	2) 14 mm	3) 12 mm
60 cm	1) 10 mm Mean = 9.3	2) 9 mm	3) 9 mm
80 cm	1) 8 mm Mean = 7.3	2) 7 mm	3) 7 mm
100 cm	1) 5 mm Mean = 5.0	2) 6 mm	3) 4 mm

In the space below present the data in a suitable table with appropriate headings.

Include the missing mean value in your table.

Distance from fan (cm)	Distance moved from meniscus (mm)			
	Trial 1	Trial 2	Trial 3	Trial 4
20	15	16	14	15.0
40	13	14	12	13.0
60	10	9	9	9.3
80	8	7	7	7.3
100	5	6	4	5.0

[4]

(iii) Use the information from the student's investigation and the equation below to estimate the mean rate of transpiration from the results at 20 cm.

Use the formula: Volume of cylinder = $\pi r^2 h$

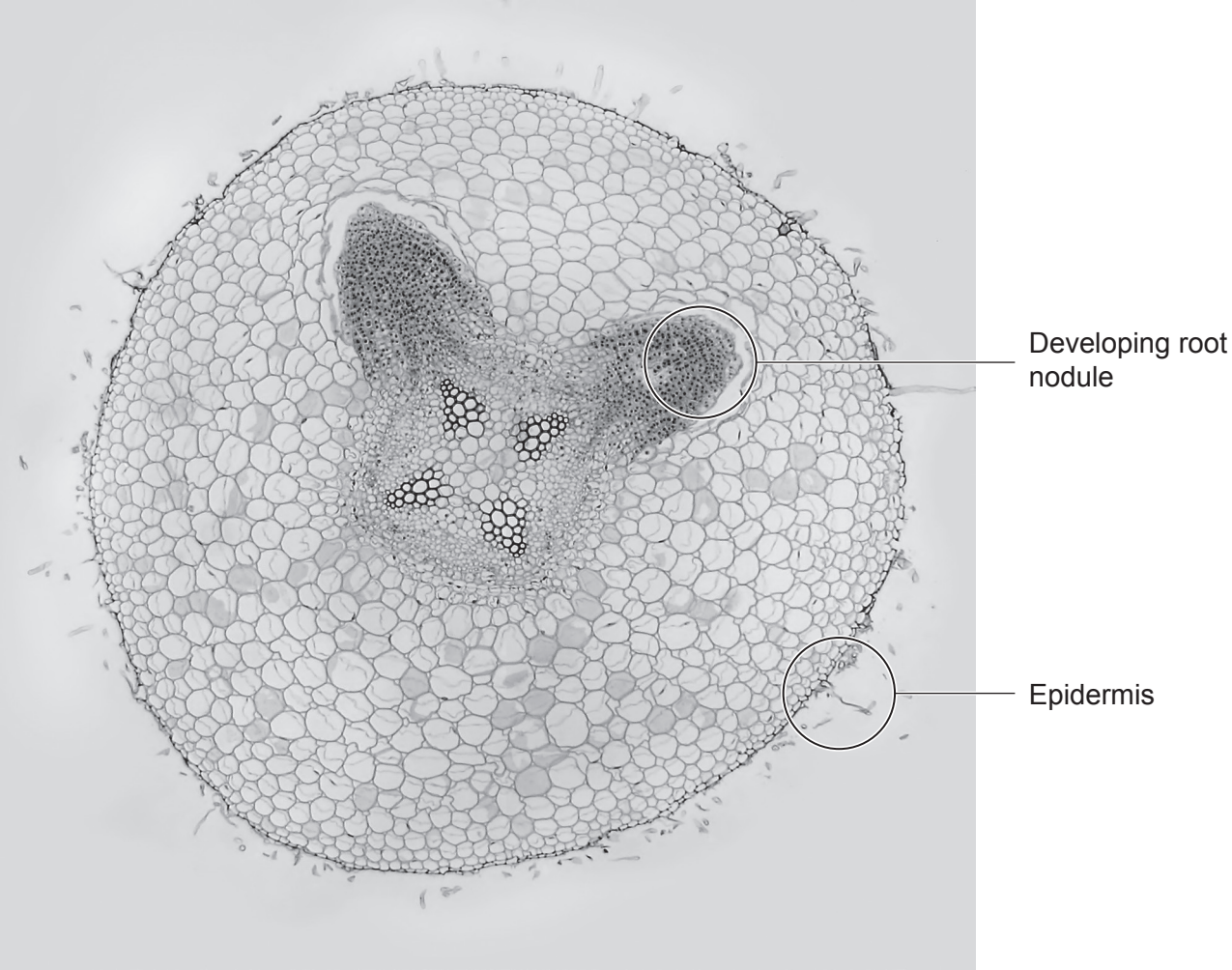
$(0.5^2 \times \pi) \times 15.0$

$11.7809 \times 2 = 23.57$

Mean rate of transpiration = 23.57 mm^3hr^{-1} **[2]**

(b) Plant species take in water through their roots.

This is a photomicrograph of a transverse section through a root of a soybean plant.

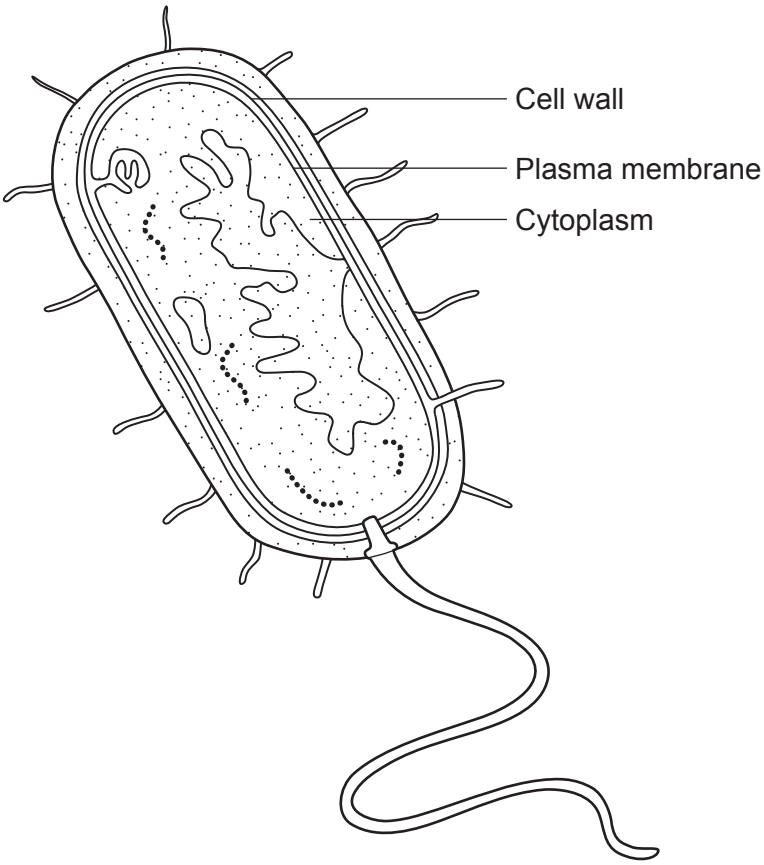


(i) Use the photomicrograph to identify whether the soybean plant is classified as dicotyledonous or monocotyledonous. Explain your choice.

- Dicotyledonous has vascular tissue in the middle
- Dicotyledonous as entire vascular tissue surrounded by endodermis.

[2]

(ii) The diagram below shows a type of cell that was extracted from the developing root nodule labelled in the photomicrograph.



Discuss the similarities and differences in structure between this cell and a root hair cell extracted from the epidermis labelled in the photomicrograph.

Similarties

- have cell wall
- have cytoplasm
- have ribosomes

Differences:-

- is eukaryotic
- does not have plasmid
- has 80s ribosomes

[4]

(c) Explain how soybean plants benefit from having root nodules.

contain nitrogen fixing bacteria ;
gain nitrogen for protein synthesis.

..... **[2]**

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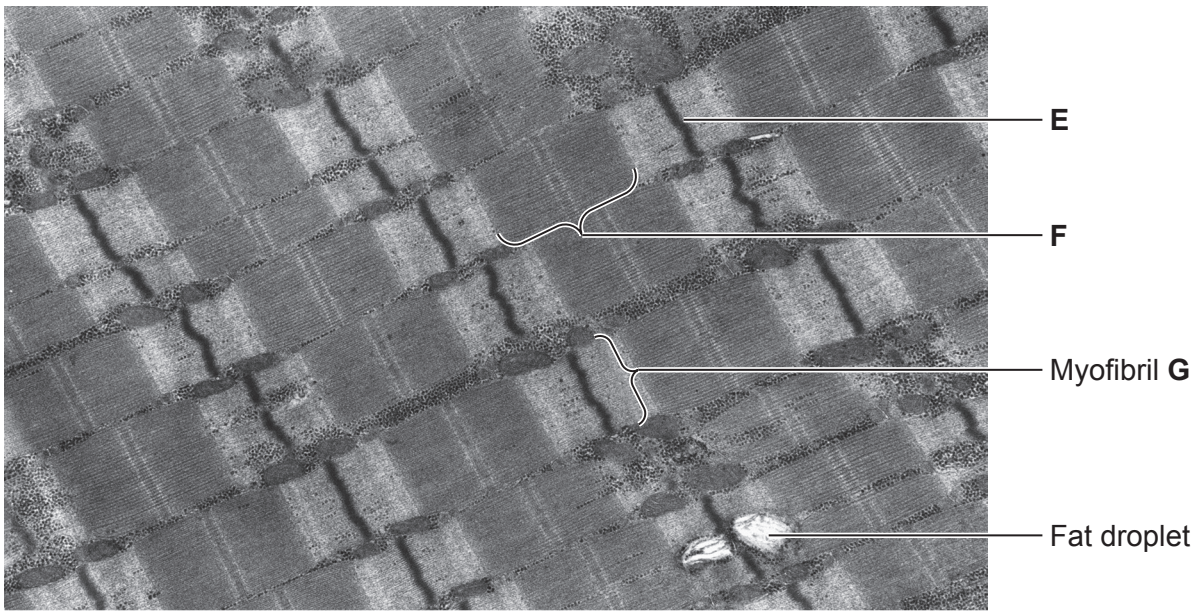
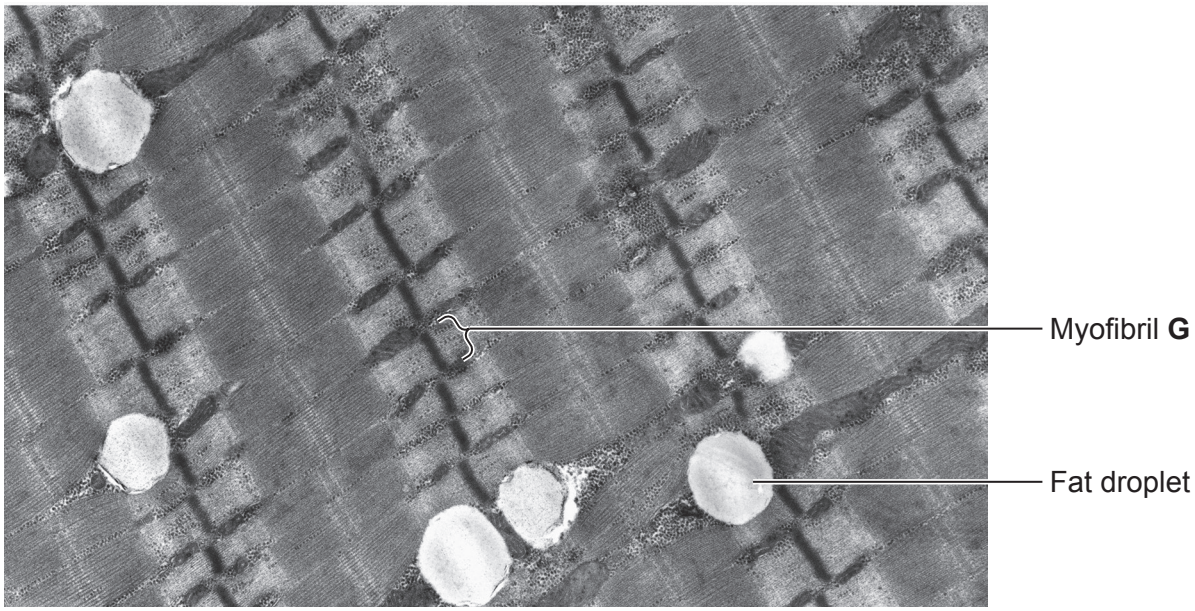
34 Researchers investigating the effects of spaceflight on skeletal muscle prepared samples of muscle tissue for viewing under a transmission electron microscope (TEM).

The two photomicrographs show samples of skeletal muscle taken from an astronaut before and after spaceflight.

Before spaceflight



After spaceflight



Magnification = 10 000×

(a) The banded pattern shown in the photomicrographs is formed by the arrangement of protein filaments in myofibrils. Some parts of the banded pattern have been labelled on one of the micrographs.

(i) Identify the parts of the banded pattern labelled **E** and **F**.

E Z-line

F A band.

[2]

(ii) The same myofibril has been labelled **G** on both micrographs.

Calculate the actual diameter of myofibril **G before spaceflight**.

image diammeter in mm ÷ 1000

1.2 ÷ 1000 = 0.0012 mm

0.0012 x 1000 = 1.2 µm

Diameter = 1.2 µm **[2]**

(iii) Spaceflight is thought to limit the production of RNA in cells.

Explain how limiting RNA production may result in the change to myofibrils seen after spaceflight.

myofibrils consist of proteins

Limited RNA so less translation

Damaged muscle fibers.

Size of myofibrils decreases.

[3]

(iv) Suggest reasons for the changes to fat droplets in the samples of skeletal muscle taken before and after spaceflight.

Due to muscle degradation

Number of fat droplets

reduction in the width of the myofibrils.

[2]

(b)* The photomicrographs were obtained using a transmission electron microscope (TEM). The researchers also obtained photomicrographs of the skeletal muscle using a light microscope and a scanning electron microscope (SEM).

They stated that the TEM micrographs would be better than both other types of microscopes for studying the protein filaments in the skeletal muscle.

Evaluate this statement.

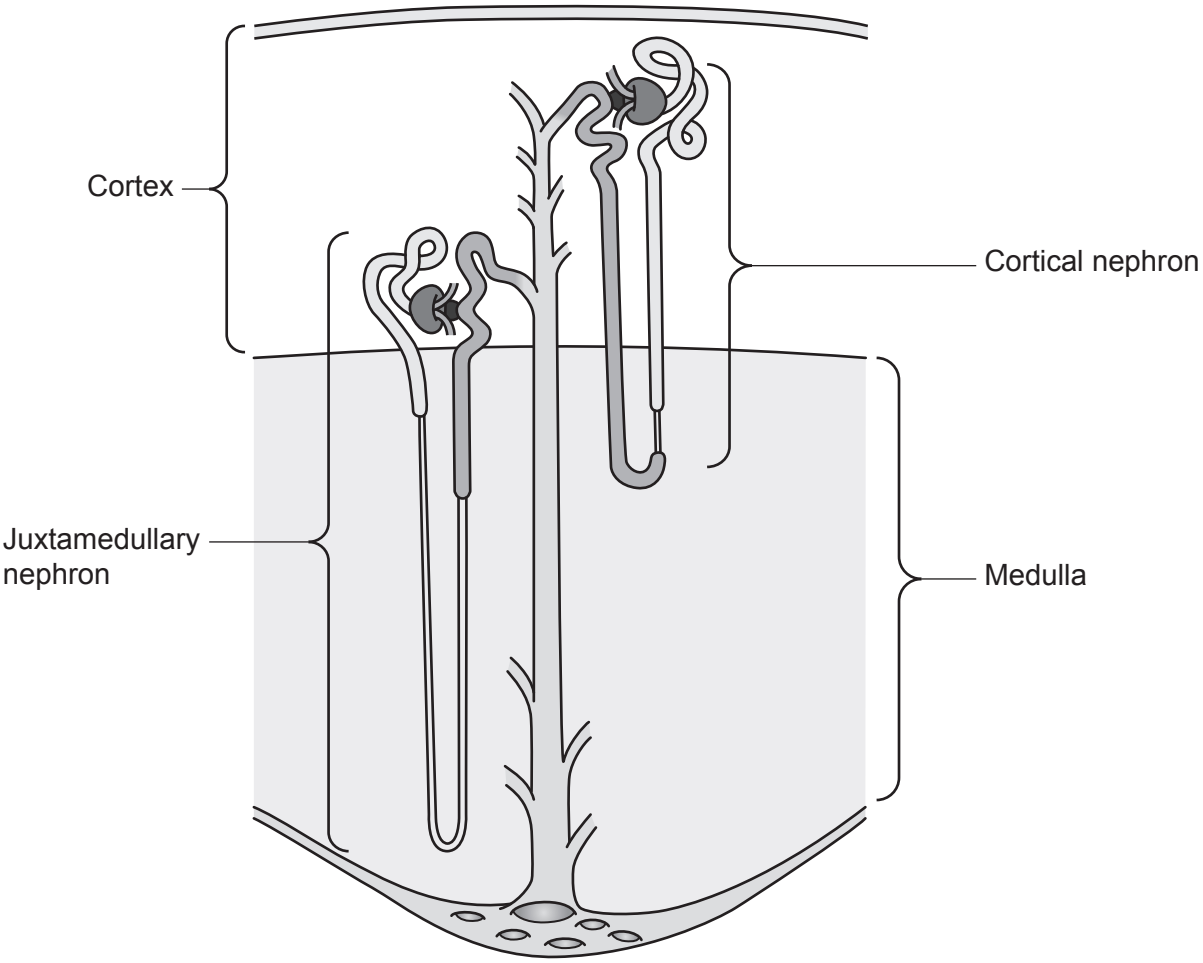
⇒ Reason why statement is supported and TEM would be better than light microscope
- higher magnification
- higher resolution
- can identify organelles

⇒ Reason why statement is supported and TEM would be better than SEM.
- higher resolution
- 2D images produced with TEM are easy to interpret
- inner structure can be seen more easily.

⇒ Reason why statement is not supported and TEM would not be better than light microscope
- High costs
- need thin samples. **[6]**

Extra answer space if required.
- artefacts may occur.

35 The diagram shows two types of nephron found in the mammalian kidney.



(a) Ultrafiltration occurs in both types of nephron.

(i) Complete the sentences about how structures in the nephron are adapted for ultrafiltration.

Blood enters the glomerulus via the afferent arteriole . Endothelial cells lining the glomerulus are separated by narrow gaps, called fenestrations that prevent blood cells leaving the blood. In addition, the basement membrane of the glomerulus provides a mesh of glycoprotein and collagen to prevent the escape of large plasma proteins. Cells lining the Bowman's capsule, called podocytes have finger-like extensions to create small gaps for filtration.

[4]

(ii) Suggest which of the nephrons has a main function in concentrating urine **and** give a reason for your choice.

Juxamedullary

Loop of Henle is Longer into medulla.

[1]

(iii) In human adults, approximately 85% of nephrons are cortical nephrons.

Calculate the total number of juxtamedullary nephrons present in a human adult with an average of 900 000 nephrons per kidney.

15% x (900,000) x 2

= 270,000

Total = 270,000 **[1]**

(b) Patients with kidney failure need long-term dialysis therapy.

Haemodialysis (HD) and peritoneal dialysis (PD) are the two main forms of dialysis. There are advantages and disadvantages with both HD and PD, but the focus for doctors when choosing dialysis therapy for their patients is survival rate.

However, recent studies show that a priority for patients on long-term dialysis is maintaining their quality of life.

In one study, data was collected using questionnaires given to dialysis patients every 6 months over an 18-month period. Patients were asked to give a score of between 1 and 10 for questions relating to how they felt their dialysis treatment affected the different areas of their life.

The table is an analysis of some of the data showing the mean score with standard deviation shown in brackets for three different categories.

	6 months		**12 months**		**18 months**	
	HD	**PD**	**HD**	**PD**	**HD**	**PD**
Sexual function	7.03 (3.25)	7.45 (3.01)	6.85 (3.02)	7.50 (2.80)	6.12 (3.09)	7.52 (3.15)
Sleep disturbance	6.82 (1.95)	6.90 (1.83)	6.71 (2.02)	6.95 (1.91)	6.65 (1.75)	6.72 (1.80)
Ability to work	2.52 (3.28)	3.70 (3.74)	2.50 (3.35)	3.70 (3.85)	2.37 (3.15)	3.20 (3.80)

(i) State **one** conclusion that can be drawn from the data and outline **two** limitations of the method that could affect the validity of your conclusion.

Conclusion Sleep disturbance was reported as being similar in both HD and PD patients.

Limitation 1 No information on whether 1 or 10 is high

Limitation 2 No information about sample size.

[3]

(ii) Explain the importance of calculating standard deviation for the data.

- measure the spread of data around the mean
- can use in Statistical test
- assess repeatability of data

[2]

(c) Transplant surgery is also used for kidney failure.

State **one** advantage and **one** disadvantage of transplant surgery.

Advantage extends life span

Disadvantage needs suitable donor.

[2]

36 Pick's disease or frontotemporal dementia (FTD) is a rare form of dementia.

(a) Symptoms of FTD include memory loss and speech deficits. Studies of brain tissue from FTD patients show the presence of inclusions known as Pick bodies that are similar to the neurofibrillary tangles found in the brain tissue of patients with Alzheimer's disease (AD).

(i) Apart from memory loss and speech deficits, suggest **two other** symptoms that may be associated with FTD.

1 Mood Changes

2 Weight Loss

[1]

(ii) Using your knowledge of AD, suggest how the formation of Pick bodies may cause the symptoms associated with FTD.

Presence of neurofibrillary tangles

protein deposit

Loss of neurons

[2]

(b) Approximately 40% of patients with FTD reported a family history of dementia.

One group of researchers investigated the role of DNA methylation in the regulation of genes associated with a risk of developing FTD.

(i) Explain why DNA methylation is **not** described as a DNA mutation.

- epigenetics
- no change to nucleotide
- gene structure does not change
- reversible

[3]

(ii) Describe the role of DNA methylation in the regulation of genes.

DNA methylation switches gene off

.....

.....

..... **[1]**

(c) Different scanning techniques are used by researchers and doctors to observe brain tissue and assess damage caused by disease or injury.

Complete the table below by deciding whether the statements about the scanning techniques used to observe brain tissue are **True (T)** or **False (F)**.

Statement	**True (T) or False (F)**
Electrical impulses sent between neurons in the brain can be detected using EEG scans.	True
MRI scans do **not** use X-rays so are safer to use during pregnancy.	True
PET scans use X-rays to construct images of internal structures.	false

[3]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.