

OCR A-LEVEL BIOLOGY B • H422

BIOLOGY



EXAM QUESTION PACK

5.2.3 THE EFFECT OF AGEING ON THE NERVOUS SYSTEM

SCORE

/67

PERCENTAGE

%

STEMUP

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- 1 An experiment collected data on the effect of ageing on reaction times.

Participants were placed into age groups, as shown in the table below.

Age group	Number of participants
18–29	43
30–39	39
40–49	45
50–59	40
60–69	44
70–79	39

Which of the statistical tests, **A** to **D**, is suitable to analyse the data produced in this experiment?

- A chi-squared test
- B paired Student's *t*-test
- C standard deviation
- D unpaired Student's *t*-test

Your answer

[1]

- 2 Alzheimer's disease is associated with several pathological changes in the brain.

Which of the options, **A** to **D**, is observed in the brain of an individual with Alzheimer's disease?

- A β -amyloid protein in synaptic vesicles
- B β -amyloid protein in the nuclei of neurones
- C neurofibrillary tangles in the cytoplasm of neurones
- D Tau protein around neurones

Your answer

[1]

3 Brain atrophy is the loss of brain tissue as a result of neuronal cell death.

A study was conducted to investigate a possible relationship between brain atrophy and levels of β -amyloid in fifty patients with Alzheimer's disease.

Paired measurements of brain volume and β -amyloid were taken from each patient using an imaging technique.

Which of the statistical tests, A to D, is appropriate to analyse the correlation of the data obtained?

- A chi squared (χ^2) test
- B paired Student's t -test
- C Spearman's rank
- D unpaired Student's t -test

Your answer

[1]

4 Glaucoma is an eye condition caused by increased pressure within the eye.

Which of the options, A to D, is a correct explanation for the increased pressure?

- A decreased production of aqueous humour
- B increased production of vitreous humour
- C poor drainage of aqueous humour
- D poor drainage of vitreous humour

Your answer

[1]

5(a) An investigation into the effects of ageing on reaction times was carried out using data from a longitudinal study of the same people over a period of time.

- A group of 25 people volunteered for a study in 1962.
- As part of the study, the mean reaction time for each person was measured and recorded.
- In 2012, ten of the same individuals were traced and volunteered to take part in a second study.
- The mean reaction time using the same method was, again, measured and recorded.

Table 4 shows the results of the investigation.

Volunteer	Reaction time (10^{-3} s)	
	aged 18–25	aged 68–75
1	262	310
2	261	305
3	262	298
4	263	298
5	262	297
6	262	303
7	258	311
8	288	298
9	290	300
10	295	298
Mean	270	302
Median		
Range		

Table 4

(i) Complete Table 4 by calculating the median and the range for both data sets. [2]

(ii) Evaluate the usefulness of the mean and the median when carrying out statistical analyses.

----- [2]

(iii) Suggest one limitation of using the **range** in a statistical analysis.

----- [1]

(b) The investigators decided to perform a paired t -test on the data in Table 4.

Explain why a paired t -test is more appropriate than an unpaired (Student's) t -test for these data.

----- [2]



These experiments may be:

- Discuss the ethical considerations of using humans and other animal species in laboratory experiments to determine the effect of drugs on reaction times.

[6]

- 6 Uncontrolled diabetes can lead to diabetic retinopathy. In this condition, the walls of blood vessels that supply the retina of the eye become weakened and cause visual symptoms.

A person with diabetic retinopathy may see dark spots that float around in the field of vision.

Suggest the cause of this symptom.

----- [2]

In diabetic retinopathy, damage to the retina can impair the function of photoreceptor cells.

Fig. 31.2 shows a vertical section through the human eye.

Three regions of the retina are labelled A to C.

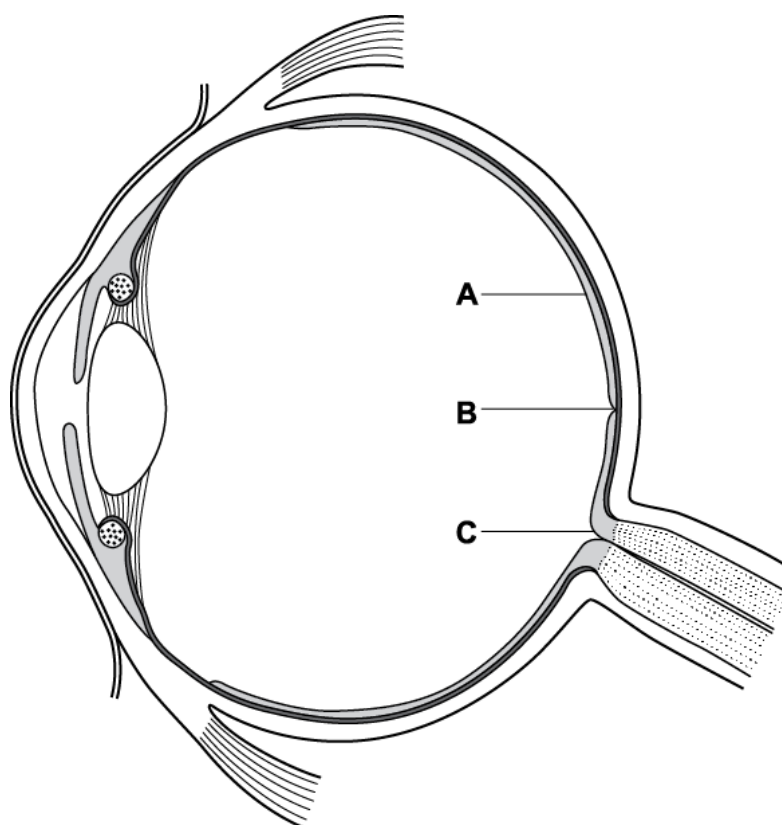


Fig. 31.2

7 Three drugs used in the treatment of patients diagnosed with mild or moderate symptoms of Alzheimer's disease underwent clinical trials.

- Patients were tested using an Alzheimer's disease assessment scale (ADAS), which assessed cognitive performance.
- Patients were tested at intervals of 6 weeks.

The results are shown in Fig. 4.1.

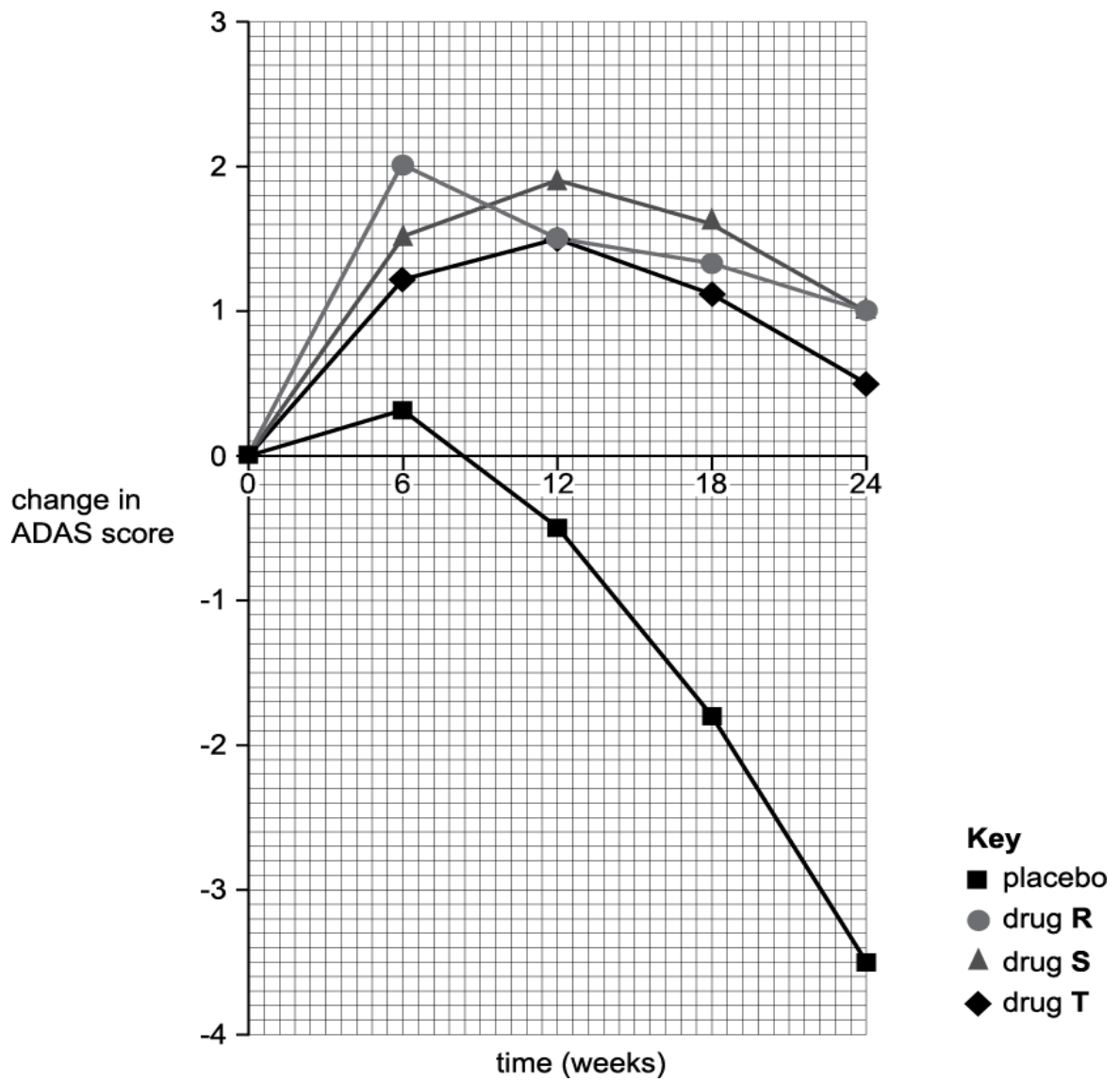


Fig. 4.1

- (i) Calculate the percentage decrease in ADAS score between 12 and 24 weeks for those patients who did not receive a drug treatment.

Show your working.

Answer % [2]

- (ii) Using the data in Fig. 4.1, evaluate the effectiveness of the three drugs in the treatment of the symptoms of Alzheimer's over the trial period.

.....

.....

.....

.....

..... [2]

- (iii) All three of the tested drugs act as inhibitors of the enzyme acetylcholinesterase.

- Drug **R** acts as an irreversible inhibitor of acetylcholinesterase.
- Drugs **S** and **T** act as competitive inhibitors.

Fig. 4.2 shows the effect of increasing acetylcholine concentration on the rate of reaction of acetylcholinesterase in the presence of drug **S**.

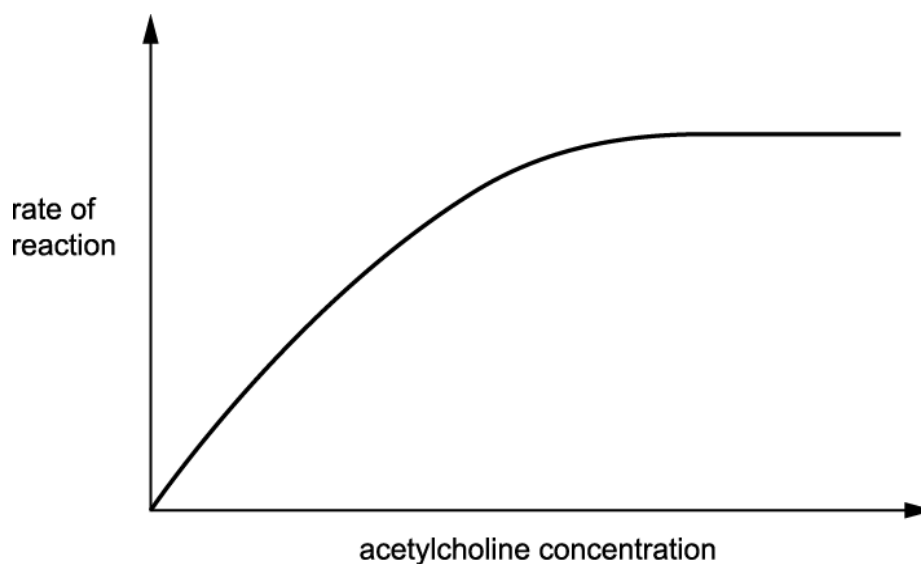


Fig. 4.2

Drug **R** was then used instead of drug **S**. Describe how the curve obtained from drug **R** would be different to the curve shown in Fig. 4.2.

----- [1]

- a part of the brain called the **SCN** receives impulses from the **optic nerve**
- the SCN regulates a gland in the brain which secretes a substance called **melatonin**
- melatonin levels in blood are lowest during the day and highest at night
- high levels of melatonin induce inactivity and sleep.

Fig. 4.1 is a summary of the interaction between the SCN and melatonin.

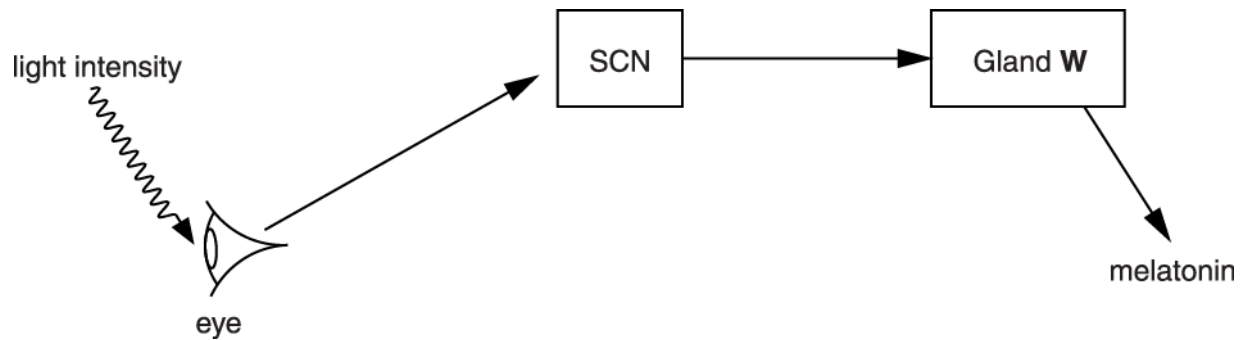


Fig. 4.1

(i) What type of gland is W?

What type of substance is melatonin?

Give a reason for your answers.

.....

.....

.....

[2]

(ii) Using the information in Fig. 4.1, suggest why circadian rhythm problems are more likely to occur in the following groups of people:

those who are housebound

.....

.....

those with untreated glaucoma

.....

those with Alzheimer's.

[3]

- 9 The World Health Organisation collects data on the global distribution of many diseases including **osteoarthritis**.
The statistics that are calculated are used in a range of epidemiological studies.

One important statistic that can be calculated is the disability-adjusted life year or **DALY**.

- One DALY can be considered as one lost year of **healthy** life.
- In North America the DALY for osteoarthritis is 796 000.
- In Africa the DALY for osteoarthritis is 650 000.

Another important statistic that can be calculated is life expectancy at birth.

- In North America life expectancy is 74.
- In Africa life expectancy is 50.

Both sets of statistics are based on data collected in the year 2000 and are for both males and females.

- (i) How does the statistical evidence support the conclusion that the onset of osteoarthritis in Africa happens at an earlier age?

[2]

- (ii) Suggest why the onset of osteoarthritis happens at an earlier age in Africa.

[2]

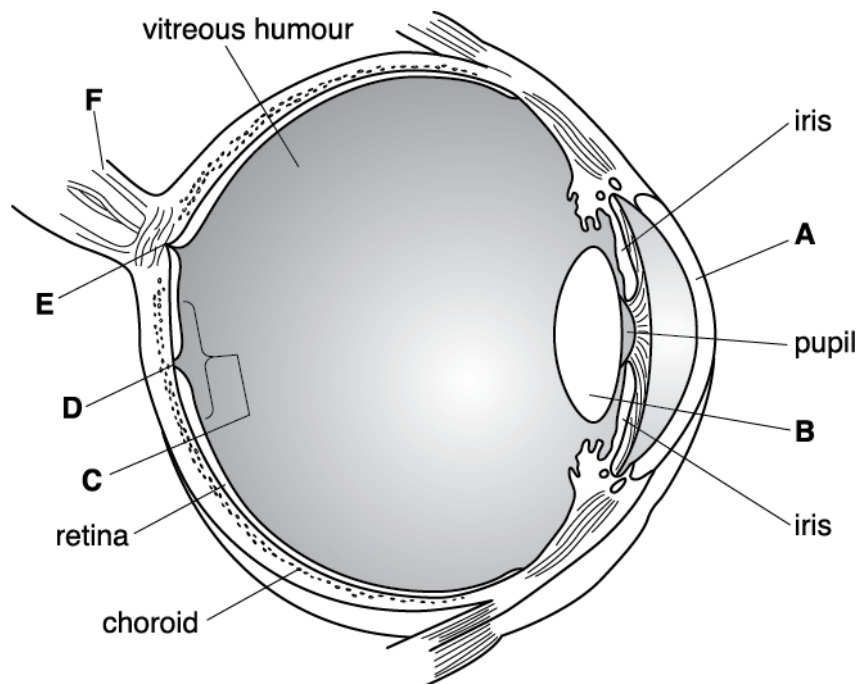
- (iii) The data used for calculating the DALYs for osteoarthritis were combined data from males and females.

Explain why it would **not** be appropriate to combine male and female data for epidemiological studies on osteoporosis.

[2]

10 Partial sight or blindness can occur as a result of damage to several different parts of the eye.

The following figure shows a diagram of the eye.



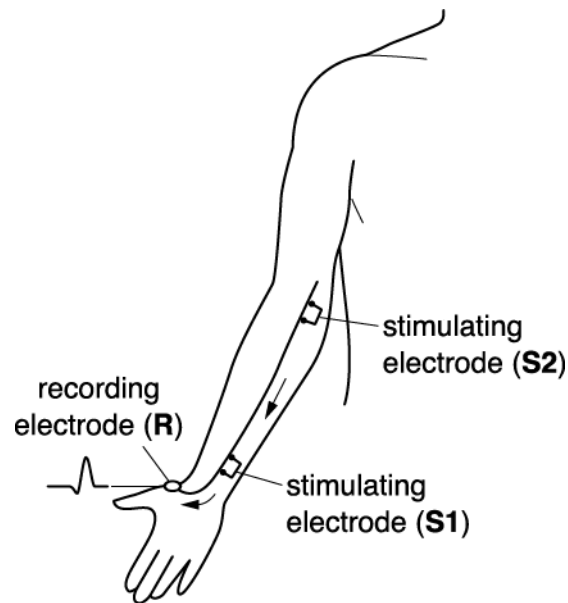
Complete the table by inserting the appropriate letter or letters from the diagram.

Description	Letter(s)
The region that is damaged if glaucoma is not treated	
The region where a cataract can form	
The region of the retina where only cones are found	
The region of the retina where both rods and cones are found	
The region of the retina where no rods or cones are found	

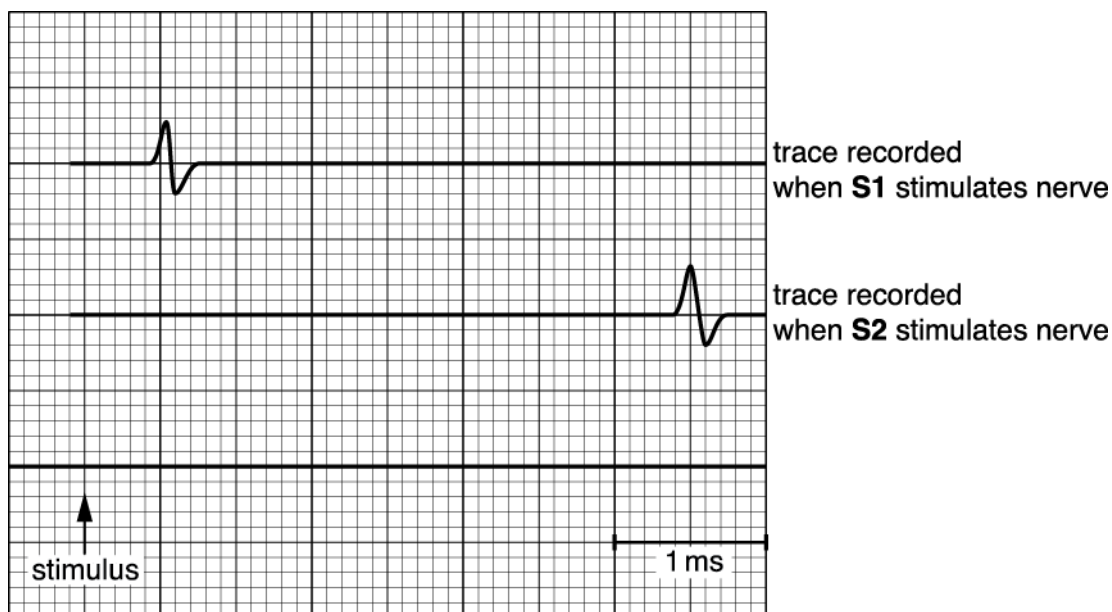
[5]

11(a) A nerve conduction velocity (NCV) test can be carried out to measure the speed of conduction of a nerve impulse.

An NCV test on a nerve in the arm is shown in the following figure.



- Two stimulating electrodes (S1 and S2) are attached to the skin above the nerve.
- The distance (D) between the stimulating electrodes is measured.
- The first electrode (S1) stimulates the nerve and the resulting electrical response is recorded by the recording electrode (R).
- The second electrode (S2) stimulates the nerve and the electrical response is also recorded by R.
- An NCV trace is obtained, such as that shown in the following graph.



(i) The nerve conduction velocity (NCV) is calculated using the formula:

$$NCV = \frac{D}{T_{S2} - T_{S1}}$$

Where:

D is the distance between the stimulating electrodes

T_{S1} is the time taken between the stimulus given at $S1$ and the wave recorded at R

T_{S2} is the time taken between the stimulus given at $S2$ and the wave recorded at R .

Calculate the nerve conduction velocity, assuming D is 20 cm.

Show your working. Give your answer to the **nearest whole number**.

Answer mm ms⁻¹ [2]

(ii) Suggest how a stimulus initiates an action potential in a motor neurone and explain how the action potential is transmitted.



71

Suggest a reason for this observation.

11

In a study of the effect of ageing on **sensory** neurones, NCV tests were carried out on 1000 people. The test was repeated five years later on 500 people from the original group. Two different nerves were tested on both arms for each subject.

The following controls were in place during the study:

- the temperature of the skin surface was kept at 32°C
- subjects diagnosed with diabetes mellitus were excluded from the study.

- (i) Explain why it was important to keep skin temperature constant **and** suggest why a temperature of 37°C was **not** selected.

[2]

- (ii) Suggest a reason why subjects with diabetes mellitus were excluded from this study.

[1]

- (iii) The results from the NCV study are given in the table.

Nerve tested	Mean velocity change after 5 years (ms^{-1})	Probability (P-value)	Confidence limits (ms^{-1})
Nerve 1	-1.1	$p < 0.0001$	-1.49, - 0.62
Nerve 2	- 0.7	$p = 0.002$	-1.15, -0.27

What **two** conclusions about conduction velocity in neurones can be drawn from **all** the information shown in the table?

[2]

12 The neurones in the sciatic nerve form part of the peripheral nervous system.

Some of the neurones connect receptors in the lower limb to the central nervous system.

Some of the neurones connect the central nervous system to different types of muscle tissue in the lower limb.

Tick the correct term or terms that apply to the sciatic nerve neurones described in the table below:

Description of neurone(s)	Sensory	Motor	Autonomic	Somatic
Stimulates muscle tissue and causes contraction				
Parasympathetic				
Contains a long dendron				
Involved in the plantar reflex				
Sympathetic				

[5]

- 13 Alzheimer's is a neurological disorder. A potential new drug treatment for Alzheimer's has entered clinical trials. The drug has passed the phase 2 trial in which it was tested on 50 patients.

A brief summary of the plan for phase 3 of the trial is as follows:

- The new drug is compared to the best treatment currently available.
- 70 patients receive the new drug in total, 35 from hospital A and 35 from hospital B.
- A placebo is not used.
- Blind trials are used.

- (i) Discuss aspects of the planned phase 3 clinical trial and explain how each aspect is likely to affect the validity of the results.

[3]

- (ii) State **two** possible causes of Alzheimer's.

1

2

[2]

- 14 As people age, damage to the peripheral nerves associated with the eye may result in poor vision due to specific eye conditions, such as age-related macular degeneration (AMD).

Which of the following could lead to the development of AMD?

- A a poor diet lacking in vitamins
- B increased pressure in the eye
- C hardening of the arteries that supply oxygen
- D damage to the optic nerve

Your answer ☐

[1]

- 15 The brain tissue of a person who has Alzheimer's disease is shown to contain neurofibrillary tangles. These are shown in the micrograph in Fig. 26.1.

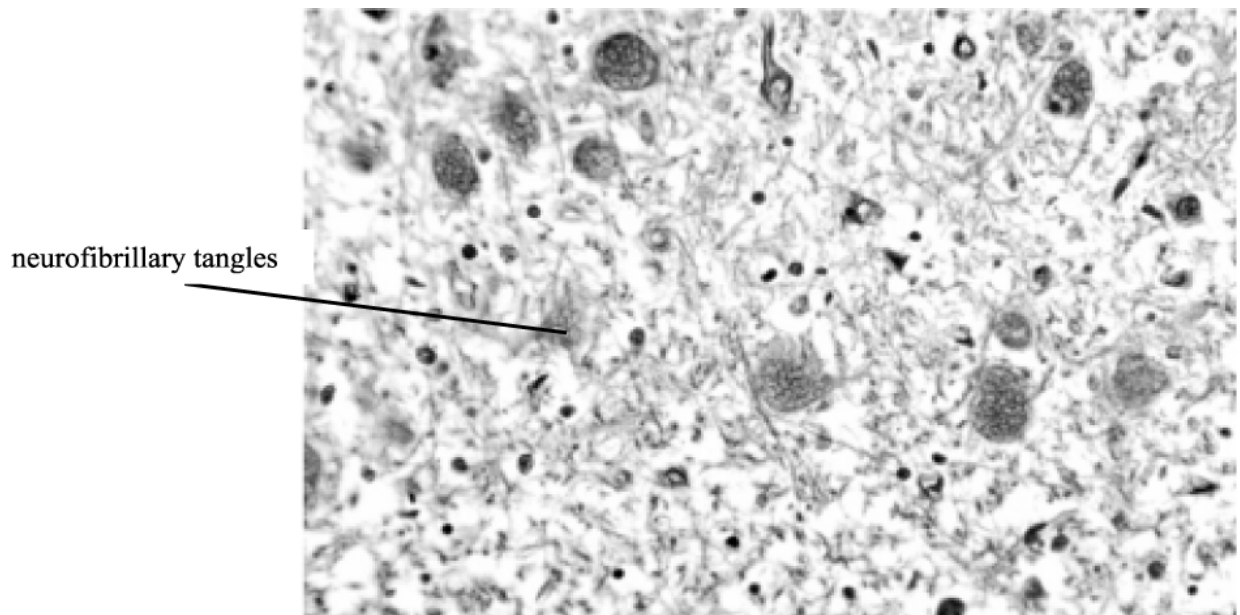


Fig. 26.1

Which of the following statements are true?

- Statement 1:** Neurofibrillary tangles contain β -amyloid protein.
- Statement 2:** Neurofibrillary tangles contain Tau protein.
- Statement 3:** Neurofibrillary tangles are caused by an accumulation of twisted protein fragments inside the neurones.

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

Your answer

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			D	1 AO2.4	
			Total	1	
2			C	1 AO1.2	<u>Examiner's Comments</u> A few candidates were able to identify that the correct answer was C. However, some candidates were often incorrectly drawn to option D in this question.  Misconception Tau proteins are abundant in neurones, but they only become harmful when they become defective forming neurofibrillary tangles.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3			C	1 AO2.4	<u>Examiner's Comments</u> Like last year, several candidates were unclear about which statistical test to apply. Here we have a clear case of an investigation into a relationship between two variables - looking for a correlation. In this case the Spearman's rank is the appropriate test. Some candidates were clearly distracted by mention of the paired measurements, but it is worth remembering that t tests are for comparing mean values, not relationships between variables; and in the case of paired t tests, two sets of measurements are taken one before and one after the investigation.  OCR support Maths for Biology website offers support to candidates in statistical tests: https://www.ocr.org.uk/subjects/biology/maths-for-biology/handling-data/ You can also use the 'Mathematical skills statistics' booklet: https://www.ocr.org.uk/Images/338621-mathematical-skills-statistics-booklet.doc
			Total	1	
4			C	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5	a	i	<i>Median</i> (aged 18–25) 262 AND (aged 68–75) 299 ✓ <i>Range</i> (aged 18–25) 37 AND (aged 68–75) 14 ✓	2	IGNORE units DO NOT ALLOW 258 to 295 or 297 to 311 as command word in the question states <i>calculate</i> Examiner's Comments Q4(a)(i) was generally answered well though some candidates did not read the data correctly and as such calculated the median incorrectly (especially for 68–75 years). Some candidates stated the interval (upper and lower values of the range) rather than the range. This was not credited as the question stated 'calculating' and as such required data processing to be undertaken.
		ii	the mean, uses all the data (in the calculation) ✓ the median, is less affected by outliers / AW ✓	2	IGNORE references to 'central tendency' as both averages provide this Examiner's Comments Candidates found Q4(a)(ii) difficult with some misinterpreting the command word 'evaluate' and/or concentrating on either the mean or the median. Some candidates gave generic comments relating to both and did not distinguish between the mean or the median e.g. 'they are averages', 'they show the central tendency of the data'.
		iii	Any one from (if one outlier is widely out compared with the other data) the range doesn't always give a true indication of the spread of data OR the range can be distorted by an outlier ✓	1 max	ALLOW 'it' for 'range' ALLOW outlier can give a false impression of the spread of data OWTTE Examiner's Comments Q4(a)(iii) was generally answered well by higher achieving candidates but weaker candidates were let down by difficulties in expressing their ideas clearly.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	b		<i>idea that the data collected are from the same individual (paired measurements) ✓</i> <i>idea of allows comparison of how each individual has changed (not how the average has changed) ✓</i>	2	IGNORE the 2 data sets are linked unqualified Examiner's Comments Q4(b) saw few candidates gaining full marks with the most common mark point awarded being MP1.
	c		Summary of instructions to markers: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)</i> <i>Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i> <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> • The science content determines the level. • The Communication Statement determines the mark within a level. Level 3 (5–6 marks) Provides a comprehensive consideration of the ethical arguments for and against the use of humans and of animals in this type of experiment. The account is well balanced <i>There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated..</i>	6	Ethical considerations may include: For animal testing • painful experiments can be carried out on animals with the use of analgesics • drugs / medicines not yet approved for human use can be used on animals • potentially lethal effects can be investigated in animal studies (e.g. sleep deprivation, drugs, gene deletion/'knock out') • lifetime effects can be studied on animals without implications for

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Level 2 (3–4 marks) Describes some of the ethical arguments for and against the use of humans and animals in this type of experiment. The account may not be fully balanced (for & against, animals & humans). <i>There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.</i> Level 1 (1–2 marks) Describes some of the arguments either for or against the use of humans or animals in this type of experiment. The account lacks detail or is not well balanced. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>		(human) family / friends For human testing - informed consent is possible for humans - human volunteers can withdraw (e.g. if experiment is painful) - idea of conclusions / results of drug effectiveness are more applicable to humans - can be used to determine effective dosage Against animal testing - informed consent is not possible for animals - animals cannot withdraw from experiments - painful experiments can be carried out on animals / objections on the basis of animal cruelty - idea of conclusions / results of drug effectiveness are not fully applicable to humans Against human testing <i>idea that</i> expenses compensation may affect human volunteer pool - lifetime effects can have implications for, family / friends / volunteer Examiner's Comments This part was generally answered well but again there was evidence of some candidates writing excessively. This often led to the communication mark being deducted within the level as the candidates often referred to irrelevant content such as references to placebos and blind/double blind trials. Those candidates that did not score above level one did not generally provide any positive comments for testing on either animals or humans i.e. the answer focused purely on the negative aspects of any form of drug testing.
			Total	13	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6			bleeding / haemorrhage, (from weakened blood vessels) ✓ ref to movement in <u>vitreous humour</u> ✓	2	
			Total	2	
7		i	600 ✓✓	2	For incorrect reading(s) from the graph but a correct calculation allow 1 max
		ii	<i>idea that</i> (over trial period), cognitive function improved / was higher than baseline for all three drugs tested OR <i>idea that</i> no significant difference between the three drugs OR <i>idea that</i> improvement not sustained / dropping back to baseline ✓ figures given in support ✓	2	
		iii	(the curve would) plateau / AW, below the curve in Fig. 4.2 ✓	1	
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
8		i	(W is an) <u>endocrine</u> (gland) AND (melatonin is a) <u>hormone</u>; <i>idea that W secretes (melatonin) into blood (stream);</i>	2	CREDIT correct reference to W being an endocrine gland and melatonin being hormone anywhere within the answer. IGNORE ref to specific glands e.g. pituitary ACCEPT amine ACCEPT reference to melatonin being transported in the blood Examiner's Comments In (i) many missed the fact that it was the type of gland that was required and gave the name of a gland. It was surprising to see how many candidates suggested it was an exocrine gland as this term does not appear on the specification.
		ii	<i>housebound</i> <i>idea that</i> light (intensity) is lower, in house/artificial light AND ref to SCN stimulated during day / melatonin (secretion) changing; <i>untreated glaucoma</i> optic nerve damaged / ref to tunnel vision / reduced peripheral vision AND SCN / gland W, not stimulated / does not respond /(high) melatonin in day / low melatonin at night <i>Alzheimer's</i> Beta amyloid protein / tau protein / plaques / neurofibrillary tangles so SCN damaged / not stimulated OR gland W / described,damaged / not stimulated (and does not produce melatonin);	3	CREDIT idea of constant light so no variation in melatonin / not normal pattern ACCEPT melatonin higher / lower than it should be / low at night / melatonin high <u>in the day</u>; DO NOT CREDIT 'optic nerve is damaged' without further qualification ACCEPT melatonin secreted in day / not at night Examiner's Comments Part (ii) was not done well. The main reason was a failure to use the information given and link this to their knowledge and understanding of the biological consequences of glaucoma and Alzheimer's. Weaker students did not answer in terms of their biological knowledge at all.
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9		i	(in Africa) idea that people die younger but DALY is (still) high; (Africa and North America) comment on the magnitude of the difference in life expectancy and DALY; Use of data in support of either statement;	2	ACCEPT idea that the DALYs are (fairly) close but there is a larg(er) difference in life expectancy CREDIT calculations e.g. (Africa) DALYs (about) 18% less whereas life expectancy (about) 32% less OR Life expectancy in Africa is 68% of that in North America but DALYs are 81.7% IGNORE references to raw data <u>Examiner's Comments</u> Part (i) required a careful consideration of the data. Weaker candidates re-stated the question and quoted figures without any further comment.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	(due to) more, manual labour / agricultural work / AW, in population; <i>idea that</i> start working as (young) children; more walking / poor footwear; lack of (sufficient) protein / vitamin C, in diet;	2	IGNORE reference to more exercise or active lifestyle (choice) IGNORE general reference to malnutrition IGNORE ref to aluminium (as this is linked to osteoporosis) <u>Examiner's Comments</u> Many candidates were able to explain the high DALY in terms of physical work from an early age. Some candidates implied it was a lifestyle choice to undertake more physical exercise. Others drifted into a discussion of low calcium or vitamin D - forgetting that they were osteoarthritis DALYs not osteoporosis.
		iii	osteoporosis, data / figures / AW, varies with gender; ref to effect of menopause; ref to validity;	2	CREDIT idea that it will be higher in females than males DO NOT CREDIT if given as part of a list <u>Examiner's Comments</u> Most candidates were aware of the effect of the menopause but fewer went on to link this to differences in the incidence in males and females. Some good references to validity were seen but, as in previous session, a list such as valid, reliable and accurate was not credited.
			Total	6	

Mark Scheme

Question			Answer/Indicative content		Marks	Guidance											
10			<table><tr><th>Description</th><th>Letter</th></tr><tr><td><i>The region damaged by untreated glaucoma</i></td><td>F</td></tr><tr><td><i>The region where a cataract can form</i></td><td>B</td></tr><tr><td><i>The region where only cones are found</i></td><td>D</td></tr><tr><td><i>The region of the retina where both rods and cones are found</i></td><td>C</td></tr><tr><td><i>The region of the retina where no rods or cones are found</i></td><td>E</td></tr></table>	Description	Letter	<i>The region damaged by untreated glaucoma</i>	F	<i>The region where a cataract can form</i>	B	<i>The region where only cones are found</i>	D	<i>The region of the retina where both rods and cones are found</i>	C	<i>The region of the retina where no rods or cones are found</i>	E	5	Examiner's Comments This was answered well with many candidates achieving full marks. Candidates had been told in the question that the allele was sex linked and given the symbols to choose from.
Description	Letter																
<i>The region damaged by untreated glaucoma</i>	F																
<i>The region where a cataract can form</i>	B																
<i>The region where only cones are found</i>	D																
<i>The region of the retina where both rods and cones are found</i>	C																
<i>The region of the retina where no rods or cones are found</i>	E																
			Total	5													

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
11	a	i	57 / 58 mms ⁻¹ ;;	2	Correct answer = 2 marks If answer is incorrect, look for 200 / 3.5 OR 20/3.5 = 1 mark 6 = 1 mark (they have calculated (5.7) correctly but not converted cm to mm) CREDIT 1 mark for an error carried forward for 200 ÷ x (any number) if answer is correct and a whole number
		ii	1. (voltage gated) sodium (ion) channels open; 2. sodium ions / diffuse in / rush in; 3. (membrane becomes) depolarised / AW; 4. <i>idea of</i> local circuits, ahead (and behind) the active zone; 5. (circuit due to) sideways movement of sodium ions; 6. Ref to (circuit / sodium ion movement) depolarisation / AW, of next region / node; 7. Ref to hyperpolarisation of, previous region / previous node; 8. ref to saltatory conduction / described; 9. ion movement (only) at nodes of Ranvier / myelin sheath insulates between nodes;	6 max	1. DO NOT CREDIT in context of acetylcholine CREDIT Na⁺ enters down a concentration gradient ACCEPT influx of sodium ions 3. CREDIT a description e.g. + 40mv IGNORE 'neurone' or 'cell' in this context 4. ACCEPT alternative wording e.g. local currents 7. CREDIT ref to refractory period in previous region
		ii	QWC;	1	AWARD any two mark points from 4, 5, 6 or 7

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	<i>idea that</i> myelin sheath is not present at birth OR myelin sheath takes time to develop; AVP;	1	DO NOT CREDIT reference to nervous system not being fully developed IGNORE reference to shorter axons / neurones e.g. ref to neurones having a smaller diameter Examiner's Comments Calculations such as that in (i) have not been asked before and it was pleasing to see how many candidates grasped the principle. The commonest answer was '6' where candidates had not converted their measurements to mm but had followed the rubric and given a whole number for their answer and this gained a mark. Part (ii) was not answered well with many candidates who referred to transmission between neurones rather than the transmission of an impulse within a neurone. The synapse is clearly taught well in Centres and candidates were anxious to display their knowledge but answers written in terms of synaptic transmission did not allow candidates to access the full mark range. The use of the word 'stimulus' in the question prompted some candidates to answer in terms of the reflex arc. Even answers which scored full marks struggled to explain how action potentials are propagated and, although many candidates wrote that the refractory period ensures a single direction of travel, few went on to explain how or why that is the case. A common mistake was candidates referring to sodium ions diffusing into the axon membrane. While lack of myelination was the most common correct answer to (iii), it was pleasing to see answers referring to small axon diameters. However, many candidates simply referred to babies being smaller or axons being shorter despite having calculated an NCV at the beginning of the question.

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	b	i	<i>Idea that</i> higher temperatures would give faster, conduction / impulses / diffusion OR lower temperatures would give slower, conduction / impulses / diffusion of ions; (not 37°C) <i>idea that</i> peripheral/skin temperature will be lower than 37°C OR 37°C is the, core body temperature / AW OR AVP;	2	IGNORE reference to controlling a variable as this is given in the question IGNORE reference to high temperatures denaturing proteins (in this context) e.g. 37°C could cause sweating (which could interfere with the readings)
		ii	<i>idea that</i> diabetes / high blood glucose leads to damaged neurones /nerves; AVP;	1	CREDIT <i>idea of</i> damage to receptors e.g. reduced sensitivity CREDIT <i>idea of</i> damage to Schwann cells or myelin sheath or reduction in myelination e.g. medication taken could interfere with the results OR low blood sugar / hypoglycaemia slows impulses

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		iii	<i>idea that</i> Conduction velocity slows, (significantly) / AW (over 5 years); <i>idea that</i> (means) not all neurones change at the same rate OR (confidence limits) changes within the same nerve varies within populations;	2	CREDIT answers in either order ACCEPT reference to age slowing transmission in neurones (without further qualification). DO NOT CREDIT references to either nerve being faster or slower (since the data is about change in velocity) ACCEPT nerve 1 changes more than nerve 2 Examiner's Comments In (i), although many candidates could explain that 37°C was core body temperature and that the skin would be cooler, too many wrote in very general terms about why it needed to be controlled. The fact that a variable has been controlled is because it would otherwise invalidate the investigation - but that statement applies to any variable. The question referred specifically to temperature and correct answers referred to higher temperatures speeding up the nerve impulse or the diffusion of ions across the axon membrane. Part (ii) proved to be a challenge and, although many candidates were able to refer to neurone damage, several candidates referred to high blood sugar resulting in the production of too much ATP. This misconception has appeared before. Part (iii) again proved a challenging question with too many candidates focussing on the statistics rather than the question which asked for conclusions about nerve conduction velocity. Good candidates spotted that velocity declined in both neurones but not all neurones declined to the same extent, while weaker candidates answered in terms of one nerve being faster than the other.
			Total	15	

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Question			Answer/Indicative content					Marks	Guidance																														
12			<table><tr><th>Description</th><th>Sensory</th><th>Motor</th><th>Autonomic</th><th>Somatic</th></tr><tr><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td></td><td></td><td>✓</td><td>✓</td><td></td></tr><tr><td>✓</td><td></td><td></td><td>(✓)</td><td>(✓)</td></tr><tr><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td></tr><tr><td></td><td></td><td>✓</td><td>✓</td><td></td></tr></table>					Description	Sensory	Motor	Autonomic	Somatic			✓	✓	✓			✓	✓		✓			(✓)	(✓)	✓	✓	✓		✓			✓	✓		5	One mark for each correct row IGNORE autonomic or somatic for this mark point
			Description	Sensory	Motor	Autonomic	Somatic																																
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13		i	Any 3 from: <i>idea that</i> 70 people is too low for a phase 3 trial (therefore reducing validity) / phase 3 trial should involve, hundreds / thousands, of people <i>idea that</i> (sample size of 70 people is) unlikely to differentiate new drug's performance from current drug (therefore reducing validity) blind trials (improve validity by), reducing / removing, bias (of patients) double blind trials (would be), improvement / AW, by removing bias of scientists <i>idea that</i> placebo cannot be used because it would be unethical in a phase 3 trial					3																															
		ii	Any 2 from: genetics head injuries age smoking					2																															
			Total					5																															
14			C					1																															
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15			C					1																															
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