

Answer all the questions.

1 The human brain is an organ, protected by the skull. The largest part of the human brain is the cerebrum. The surface of the cerebrum is covered by a highly folded region of tissue, called the cerebral cortex. The cerebrum contains regions of mostly myelinated axons, called white matter, and regions of mostly cell bodies and dendrites, called grey matter.

(a) Explain why the cerebral cortex is a tissue, whereas the brain is an organ.

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.....[3]

(b) Explain the advantage of the cerebral cortex being highly folded.

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.....[2]

(c) Cerebrospinal fluid (CSF) surrounds the brain and fills the central cavities, known as ventricles.
Suggest **two** functions of CSF.

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2
.....[2]

Fig. 1.1 shows the surface of the cerebrum and the location of some of its functions.

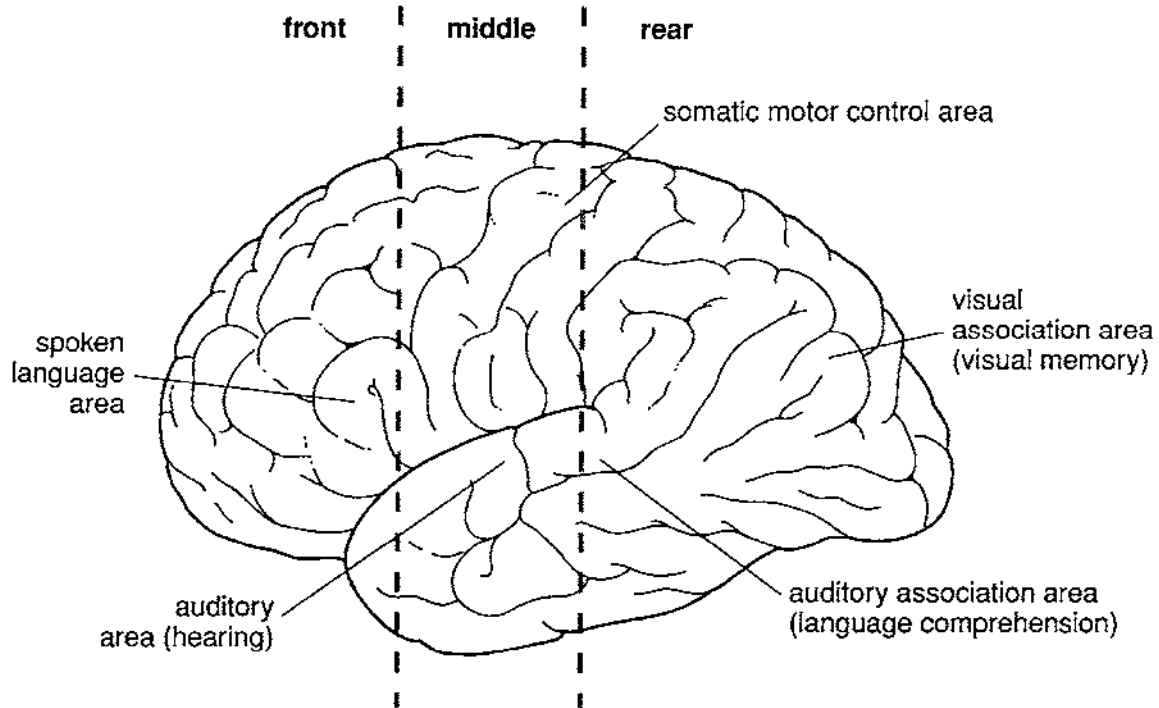


Fig. 1.1

(d) The following is a list of the functions of the brain. Put a tick (✓) in the box next to the function performed by the cerebrum.

control of the autonomic nervous system

coordination of posture

planning a task

control of heart rate

[1]

2 Fig. 2.1 is a diagram showing four types of cell in a gastric gland of the stomach wall. These cells are involved in the secretion of gastric juice. Some of the stages in controlling the release of gastric juice are shown in Fig. 2.1.

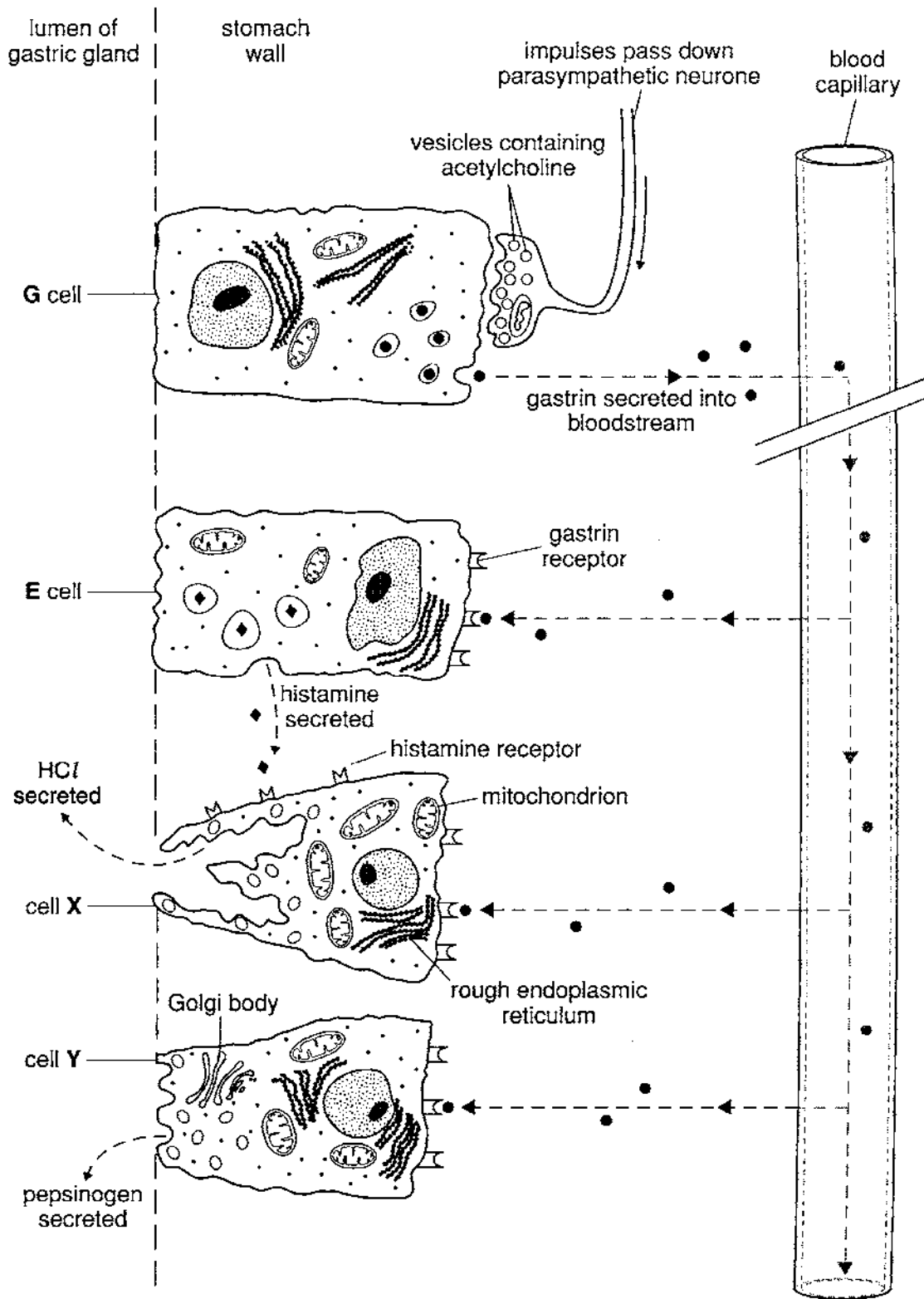


Fig. 2.1

(a) Name:

cell X

cell Y

one other component of gastric juice, secreted by cells in a gastric gland, which is **not** shown in Fig. 2.1.

.....[3]

(b) (i) Cells of type X have many mitochondria.
Explain how the large number of mitochondria in cells of type X is related to the function of these cells.

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.....[2]

(ii) Describe the role of the Golgi body in cell Y.

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(c) Describe, **using only the information in Fig. 2.1**, the sequence of events leading to the release of hydrochloric acid.

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- (d) Hydrochloric acid can damage cells of the stomach wall, leading to the formation of an ulcer.

Suggest how certain antihistamine drugs, which have a similar shape to the histamine molecule, reduce the incidence of ulcers.

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.....[2]

- (e) Pepsin is an endopeptidase enzyme, which catalyses hydrolysis reactions. Explain what is meant by

endopeptidase;

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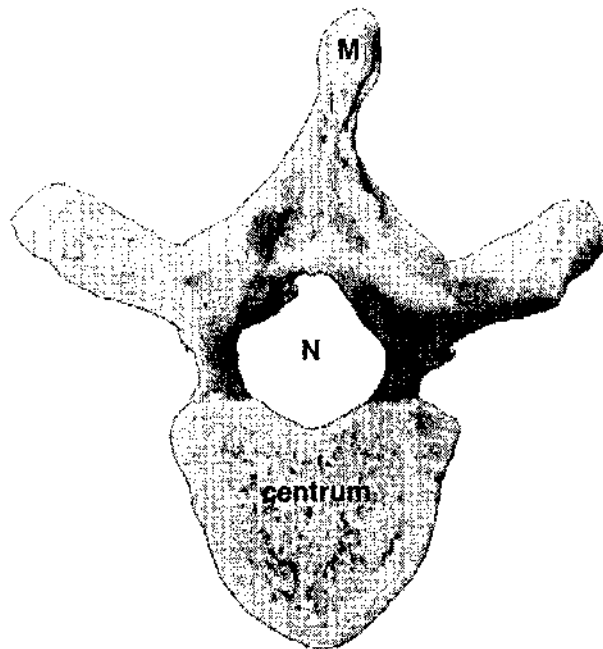
hydrolysis reactions.

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.....[3]

[Total: 17]

- 3 Fig. 3.1 shows two types of vertebrae from the vertebral column of a mammal, shown to the same scale.

thoracic vertebra



lumbar vertebra

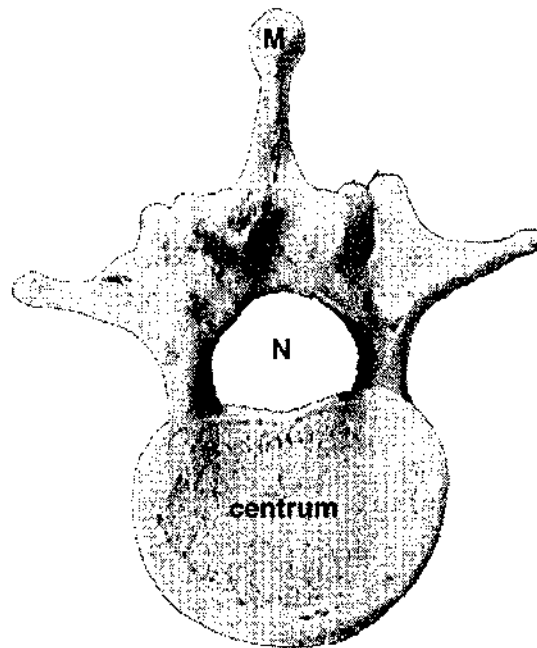


Fig. 3.1

(a) Name **M** and **N** and describe **one** function of each.

M

function

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N

function

.....[4]

(b) State why the centrum in the lumbar vertebra is larger than that in the thoracic vertebra.

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.....[1]

(c) Label a transverse process and an articular process **on the lumbar vertebra in Fig. 3.1**. Use the letters **T** and **A** as follows:

T – transverse process

A – articular process

[2]

- (c) Describe the **similarities** and **differences** between the metabolism of nitrogen-containing compounds in inactive brown bears, **as described in the passage**, and in humans.

similarities

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differences

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.....[5]

The blood plasma cholesterol concentration of inactive brown bears rises to twice the concentration found in normally active bears and in humans. However, brown bears do not suffer any of the cardiovascular diseases associated with high cholesterol concentrations in humans, as their liver produces a protective substance, which prevents these diseases from developing.

- (d) Explain the importance of cholesterol in the metabolism of mammals.

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(e) Suggest how the protective substance produced by their liver prevents brown bears developing cardiovascular diseases.

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.....[2]

[Total: 15]

- 5 When a book is held in the hand, as shown in Fig. 5.1 **A**, there is a constant load. The muscles of the upper arm contract to produce a force that opposes the load, so maintaining the position of the hand.

Muscle spindles are a type of stretch receptor, which detect changes in the length of muscles.

When a second book is placed in the hand, as shown in Fig. 5.1 **B**, the load increases. This stretches the muscle spindle resulting in an almost immediate increase in the contraction of the muscles of the upper arm, to maintain the position of the hand, as shown in Fig. 5.1 **C**.

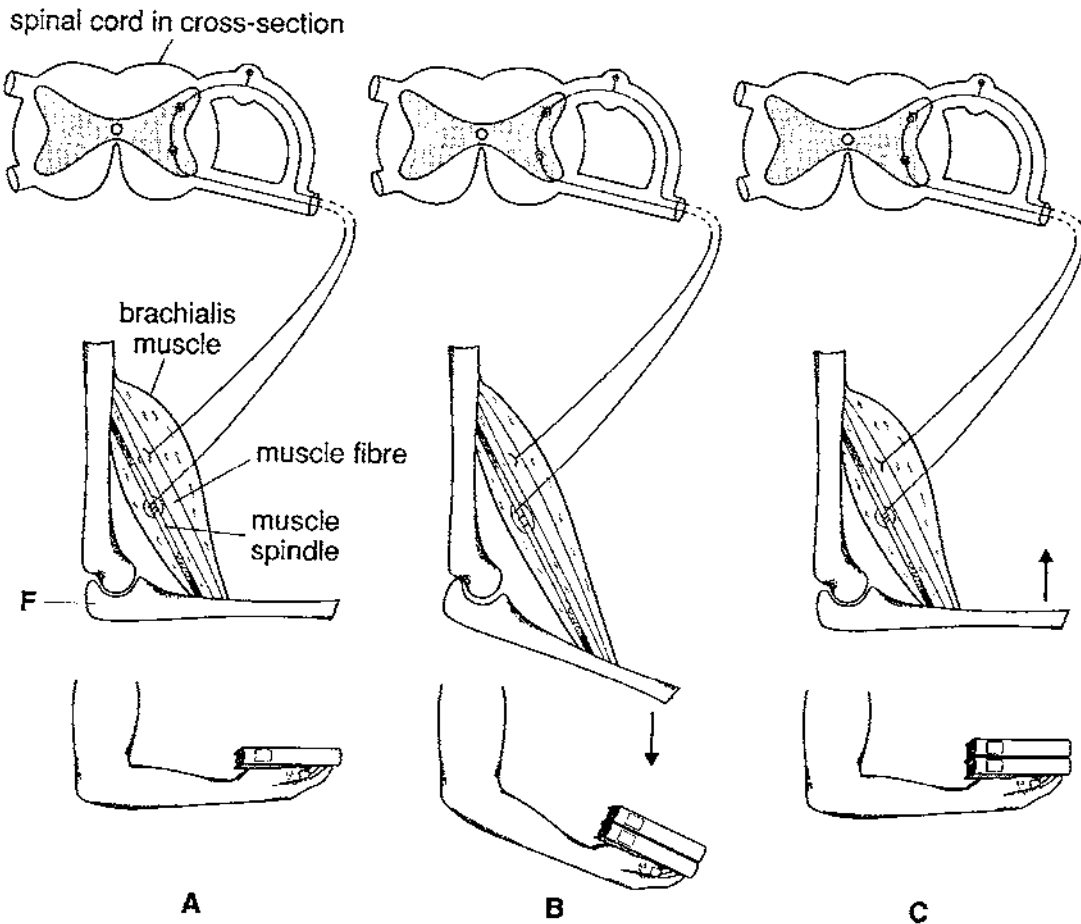


Fig. 5.1

- (a) Name bone F.

.....[1]

6 Fig. 6.1 shows the main structures of the human ear.

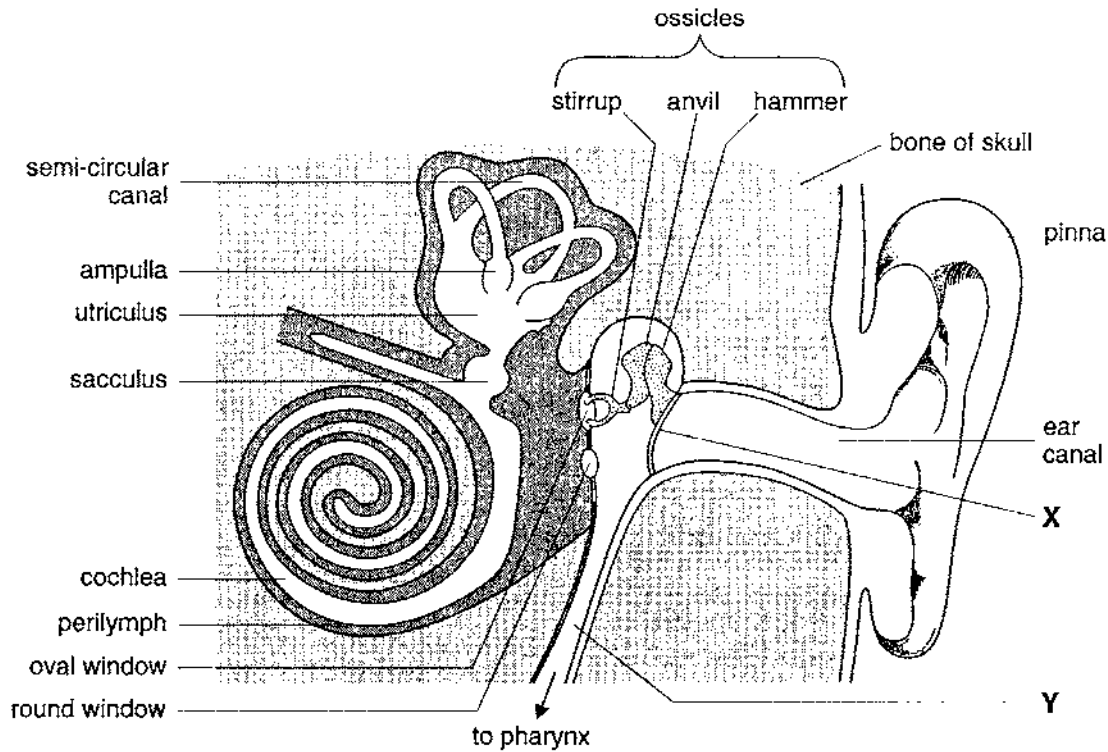


Fig. 6.1

(a) Name structures X and Y and state their roles.

X

role

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Y

role

.....[4]

(b) Muscles are attached to the auditory ossicles. When the ear detects very loud sounds, these muscles are stimulated to contract. Suggest one advantage of this.

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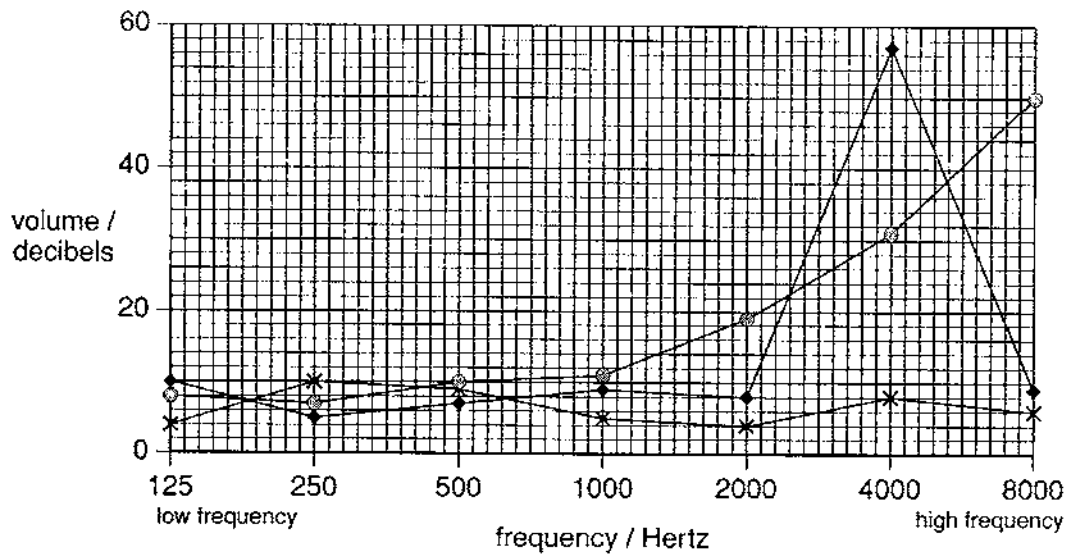
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.....[2]

- (c) Hearing tests were carried out on three people. Each person was exposed to individual sounds of different frequencies. Each sound was delivered at an increasing volume until the person indicated that they could hear the sound.

The results of these hearing tests are shown in Fig. 6.2.

Each plotted point indicates the **lowest volume** of each frequency of sound that could be heard by each person.



key:

- x = person A normal hearing
- = person B age-related hearing loss
- ◆ = person C noise-induced hearing loss

Fig. 6.2

(i) Using data from Fig. 6.2, compare the results of the hearing tests for persons **A**, **B** and **C**.

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.....[3]

(ii) Explain the reason for the hearing loss shown by person **C**.

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.....[2]

(iii) Suggest **two** factors that should be controlled when the hearing tests are carried out, in order to collect valid data.

1
2[2]

[Total: 13]

END OF QUESTION PAPER

Mark Scheme 2805/05
June 2005

Mammalian Physiology and Behaviour

Question	Expected Answers	Marks
(a)	X = oxyntic / parietal ; Y = chief / peptic ; A zymogen lipase / mucus / water / (Castle's) intrinsic factor / HCO ₃ ⁻ ;	3
(b) (i)	<u>aerobic</u> respiration / supply ATP / supply energy ; R produce energy (for) active transport / pumping ; of hydrogen ions / protons ; exocytosis ;	max 2
(b) (ii)	modification / processing / idea of change in structure, of protein ; packaging / making vesicles ; of, pepsinogen / inactive enzyme / precursor ; R protein or pepsin	max 2
(c)	1 impulses along, parasympathetic / motor, neurone / axon ; A vagus 2 vesicles move towards membrane ; 3 release of acetylcholine ; 4 (causes) release of gastrin (from G cell) ; 5 gastrin, enters capillary / carried in blood / AW ; 6 gastrin binds to receptors on E cell ; 7 (causes) histamine release ; 8 histamine / gastrin, binds to receptors on, cell X / oxyntic cell / parietal cell ; 9 <u>exocytosis</u> of, ACh / gastrin / histamine ; 10 <u>diffusion</u> between cells of, histamine / gastrin / ACh ;	max 5
(d)	idea of complementary shape ; bind to / blocks, (histamine) receptors / histamine binding site ; less / no, secretion of HCl ;	max 2
(e)	<i>endopeptidase</i> breaks / hydrolyses, peptide bond ; within, polypeptide / protein ; A 'breaks up into smaller pieces' <i>hydrolysis</i> breaking of, suitable named bond ; using / adding, water ;	max 3

[Total: 17]

- 3 (a) **M** = neural spine / neural process ;
attachment of, ligaments / muscles ; **R** articulates
- N** = neural canal / neural channel / foramen ;
protects / allows passage of, spinal cord ; **R** spine **4**
- (b) support greater, load / weight ; *comparative statement* **1**
- (c) **T** correctly labelled ;
A correctly labelled ; **2**
- (d) *C1 to C14 to max 5*
- C1** osteoarthritis affects cartilage ;
C2 osteoporosis affects bone ;
- C3** osteoarthritis due to 'wear and tear' on joints ; **A** ref to 'load bearing'
C4 vigorous use / overuse, of joints ;
C5 ref to, sport / dance / lifting job ; **A** relevant activity
C6 more cartilage breakdown than replacement ;
C7 less, collagen / glycoprotein ;
- C8** osteoporosis due to loss of bone, mass / density ;
C9 idea of osteoclasts more active than osteoblasts ;
- C10** loss of calcium phosphate / demineralisation ;
C11 ref to, menopause / low oestrogen ;
C12 diet low in, calcium / vitamin D ;
C13 bone density less than 648 mg cm^{-3} ;
C14 AVP ; e.g. smoking / steroid use
- S1 to S6 to max 3*
- S1** pain during movement in osteoarthritis ;
S2 reduced mobility (of joint / limb) ;
S3 inflammation of joint ;
- S4** (increased chance of) fractures in osteoporosis ;
S5 immobility ;
S6 pain qualified ; e.g. sciatica ;
S7 AVP ; **max 7**
- QWC** – legible text with accurate spelling, punctuation and grammar ; **1**

[Total: 15]

Question	Expected Answers	Marks
4 (a)	ref parasympathetic NS / AW ; sympathetic NS less active / AW ; more impulses in vagus nerve / less impulses in accelerator nerve ; more acetylcholine / less noradrenaline ; effect on SAN ;	max 3
(b)	<i>any two of</i> fibrinogen ; R fibrin prothrombin ; R thrombin albumin ; A albumen (named) globulin ; R immunoglobulin or antibodies AVP ; e.g. transferrin	max 2
(c)	<i>similarities</i> 1 production of urea ; 2 urea transported in blood ; 3 urea filtered from blood ; 4 synthesis of proteins from amino acids ; <i>differences (assume refs are to brown bears unless otherwise stated)</i> 5 amino acids synthesised from ammonia ; 6 <u>all</u> urea reabsorbed ; 7 from kidney <u>and</u> bladder ; 8 urea converted to ammonia by <u>bacteria</u> ; 9 AVP ; e.g. (humans) less tolerant to high ammonia (in blood)	max 5
(d)	component of cell membranes / AW ; ref to, mechanical stability / impermeability / fluidity ; production of, steroid hormone / named hormone ; production of vitamin D ; production of bile salts ;	<i>ignore rigidity</i> max 3
(e)	increases high density lipoproteins (HDLs) ; reduces low density lipoproteins (LDL) ; prevents, deposition of cholesterol / plaques / atherosclerosis ;	max 2

[Total: 15]

Question	Expected Answers	Marks
5 (a)	ulna ;	1
(b)	rapid / almost immediate / AW ; automatic / no conscious thought / does not involve brain ; (co-ordinated by) spinal cord / (only) three neurones involved ; no learning / innate / instinctive / AW ;	max 3
(c)	<ol style="list-style-type: none"> 1 depolarisation of spindle ; 2 generator / receptor, potential ; 3 ref to threshold ; 4 action potential / impulse ; 5 sensory neurone ; 6 synapse with, relay / intermediate, neurone ; 7 exocytosis of, neurotransmitter / ACh ; A description of exocytosis 8 diffusion (of neurotransmitter / ACh) across cleft ; 9 action potential in motor neurone ; 10 to, end plate / neuromuscular junction ; 11 binding of transmitter to <u>receptors</u> (on sarcolemma) ; 12 depolarisation of sarcolemma / AW ; 13 spreads down T-tubules ; A T-tubes 14 calcium ions released from, sarcoplasmic reticulum / SER / cisternae ; 15 calcium ions bind to troponin ; 16 tropomyosin moves ; 17 exposes myosin binding site (on actin) ; 18 ref to, sliding filaments / cross-bridges / ratchet mechanism ; 19 AVP ; e.g. sarcomere shortens / ATPase involved 	max 8
	QWC – clear well organised, using specialist terms ;	1
	<i>award the QWC mark if four of the following are used in correct context</i>	
	depolarisation T-tubules	
	threshold sarcoplasmic reticulum	
	synapse troponin	
	sarcolemma tropomyosin	
(d)	<ol style="list-style-type: none"> 1 proteins needed for repair / AW ; 2 more transcription of, DNA / genes ; 3 more translation ; 4 protein synthesis ; 5 named protein ; e.g. actin / myosin / troponin / tropomyosin <p><i>ignore all refs to muscle contraction</i></p> <ol style="list-style-type: none"> 6 more <u>aerobic</u> respiration ; 7 so more, energy released / ATP produced ; 8 (energy required for) condensation / anabolic, reactions ; 9 (energy required for) formation of peptide bonds ; 10 (energy required for) formation of extra mRNA ; 	max 5

[Total: 18]

Question	Expected Answers	Marks
6 (a)	<p>X = tympanum / tympanic membrane / eardrum ; passes vibrations to, ossicles / malleus / hammer ;</p> <p>Y = Eustachian, tube / canal ; equalises pressure (on either side of tympanum) ;</p>	4
(b)	<p>prevent damage to ossicles ; prevent damage to, cochlea / organ of Corti / sensory hair cells ;</p>	2
(c) (i)	<p>1 little difference / similar results, up to 1,000 (Hz) ; R no difference 2 no, loss of hearing / increase in volume of test sounds, for person A ; 3 increasing, hearing loss / volume of test sounds, for person B (above 1,000Hz) ; 4 large, hearing loss / increase in volume of test sound, for person C at <u>4,000</u> (Hz) ; 5 quote fig(a) with both units ;</p>	max 3
(ii)	<p>loud / damaging, sound was of, one frequency / 4 000 Hz ; (causes) damage to / loss of, stereocilia / hair cells ; in (only) one region ; of, basilar membrane / organ of Corti / hair cells ;</p>	max 2
(iii)	<p>(testing) apparatus ; background noise / no background noise ; time of day ; same number of tests at each frequency ; same range of frequencies ; AVP ; e.g. alertness of patient R gender, age</p>	max 2
		[Total: 13]