



HUMAN BIOLOGICAL SCIENCE

Stage 3

WACE Examination 2012

Marking Key

Marking keys are an explicit statement about what the examiner expects of candidates when they respond to a question. They are essential to fair assessment because their proper construction underpins reliability and validity.

When examiners design an examination, they develop provisional marking keys that can be reviewed at a marking key ratification meeting and modified as necessary in the light of candidate responses.

Section One: Multiple-choice

30% (30 Marks)

Question	Answer
1	b
2	a
3	c
4	d
5	c
6	d
7	b
8	b
9	c
10	d
11	b
12	b
13	a
14	a
15	c
16	a
17	a
18	c
19	d
20	a
21	b
22	d
23	d
24	a
25	c
26	d
27	c
28	b
29	d
30	a

a = 8
b = 7
c = 7
d = 8

Section Two: Short answer

50% (100 Marks)

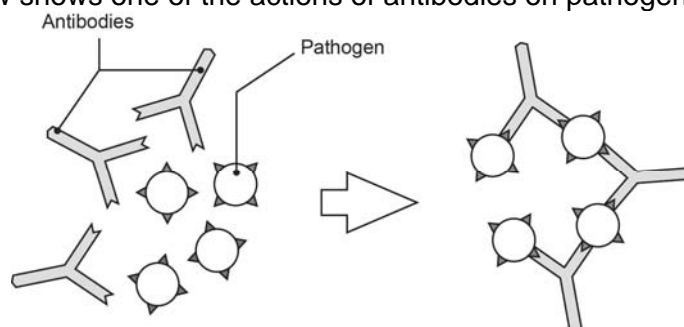
Question 31

(10 marks)

- (a) Immunity can be classed as passive or active and natural or artificial. Complete the table below, describing the different types of immunity. (4 marks)

Description			Marks
	Passive	Active	
Natural	Antibodies from mother to baby/ breast milk/ colostrum/ placenta	Own body manufactures antibodies from an attack of the disease/ pathogen/ non-self antigen	1–2
Artificial	Antibodies/serum/ antitoxin/ antivenom/ injected	Own body manufactures antibodies from injection of antigen/ vaccination	1–2
			Total 4

- (b) The diagram below shows one of the actions of antibodies on pathogens.



- (i) What action of antibodies does the diagram represent? (1 mark)

Description	Marks
Agglutination/ clumping together of the pathogen	1
	Total 1

- (ii) Describe **three** other ways in which antibodies can act on pathogens to help fight infection. (3 marks)

Description	Marks
Any 3 of the following:	1–3
<ul style="list-style-type: none">• Combine with foreign bacterial toxins• Neutralise them/ inactivate them/ produce toxins• Bind to surface of viruses• Prevent viruses decoating/prevent them entering cells/coat bacteria• Enhance phagocytosis/ make them more easily consumed by phagocytes/ macrophages/ opson/ opsonisation• Dissolve organisms/ membrane• Make soluble substances insoluble/ form a precipitate• Make bacteria/ foreign cell membranes permeable/ lysins/ lysis	
	Total 3

- (iii) Name the type of lymphocyte responsible for the production of antibodies. (1 mark)

Description	Marks
B/ B cells/ plasma cells	1
	Total 1

- (c) Vaccines are considered a safe and reliable way of increasing the immunity of populations. However, there are risks associated with vaccines.

Identify **one** risk associated with the production or use of vaccines. (1 mark)

Description	Marks
Any 1 of the following: <ul style="list-style-type: none">• Allergic reaction• Cross-species disease introduction• Contamination from preservatives (formaldehyde/ carbolic acid/ aluminium phosphate/ acetone) found in vaccine• Mutation of pathogen making the vaccine ineffective/pathogen resistance• Contracting the disease	1
	Total 1

Question 32**(12 marks)**

An investigation was carried out into the effects of administering the hormone thyroxine to patients with a malfunction of the thyroid gland. Two groups of patients were treated; Group A received the hormone and Group B received a placebo. The basal metabolic rate (BMR) of the patients in the two groups was taken over a period of three weeks.

All patients in both groups began with a similar BMR which averaged 30% below normal. After three weeks, patients in Group A had raised their BMR on average to 1% below normal. Group B still had an average BMR of 30% below normal.

- (a) Suggest an hypothesis this experiment was designed to test. (1 mark)

Description	Marks
The hormone/ thyroxine raises BMR (in people with low thyroid function).	1
	Total 1

- (b) A placebo is an ineffective treatment for a medical condition. It is intended to ensure that the patients don't know whether they are receiving the effective treatment or not and therefore removes any potential psychological effect.

What role does a placebo play in a scientific experiment? (1 mark)

Description	Marks
Any 1 of the following: <ul style="list-style-type: none">• Control/ comparison• To enable experimental variable to be tested/ testing the application of the drug	1
	Total 1

- (c) Apart from those mentioned in the experiment, suggest **two** variables that would need to be controlled to ensure that this experiment was reliable. (2 marks)

Description	Marks
Any 2 of the following:	
<ul style="list-style-type: none">• same method of administration of the hormone and placebo• same amount of hormone and placebo• same time of administration of hormone and placebo• same age range• similar genetic factors• same proportion of gender• similar general health/ medication interaction• similar nutritional status/ diet/ iodine intake	1–2
	Total 2

- (d) (i) Name the condition these patients were suffering from. (1 mark)

Description	Marks
Hypothyroidism/ Hashimoto Disease	1
	Total 1

- (ii) State **two** symptoms, apart from low BMR, that they would be displaying before treatment. (2 marks)

Description	Marks
Any 2 of the following:	
<ul style="list-style-type: none">• weight gain• fatigue• decreased heart rate• decreased blood pressure• cold intolerance• goitre• poor CNS development• slow brain function• low thyroid levels• muscle pain	1–2
	Total 2

- (e) To maintain thyroid function and a normal BMR, a series of events must take place involving the thyroid gland and its interaction with two other structures in the body. Describe the series of events involving the thyroid gland and these other two structures that would occur to prevent a healthy person's BMR from dropping to below normal levels. (5 marks)

Description	Marks
Any 5 of the following:	
<ul style="list-style-type: none">• hypothalamus detects low thyroxine/BMR/temperature• hypothalamus releases TSHRF/releasing factor• sends to anterior pituitary• releases TSH/thyroid stimulating hormone• stimulates thyroid gland• produces thyroxine	1–5
	Total 5

Question 33

(12 marks)

Identical twins Ross and Richard, aged 45, are taking part in a study in epigenetics. Both men have the inherited condition myopia, commonly known as short-sightedness. Ross has very severe myopia and needs to wear glasses all the time. Richard has mild myopia and only needs to wear glasses while driving.

- (a) Describe why Ross and Richard are considered good subjects for a study in epigenetics. (2 marks)

Description	Marks
They have the same genetic code/ DNA	1
They show a different phenotype/ physical trait/ characteristic	1
	Total 2

- (b) As part of the study, Ross and Richard had a profile of their DNA taken. Name and describe the process scientists would have used to profile their DNA. (5 marks)

Description	Marks
Electrophoresis	1
Restriction enzyme used to cut DNA into pieces	1–4
DNA pieces are placed at one end of a bed of gel	
An electric current is passed through the gel/ voltage applied across the gel	
The DNA pieces move through the gel at different speeds/ smaller pieces move faster than large ones/ negatively charged DNA moves to positive end	
Bands form representing segments/sizes of DNA	Total 5

- (c) Using the theory of epigenetics, explain why Ross and Richard have different degrees of severity of myopia. (3 marks)

Description	Marks
Any 3 of the following	1-3
• They have been exposed to different environmental conditions	
• Environment has altered their epigenome/ has not altered their DNA	
• Methylation/ histone modification	
• Different genes switched on or off/expressed/suppressed	Total 3

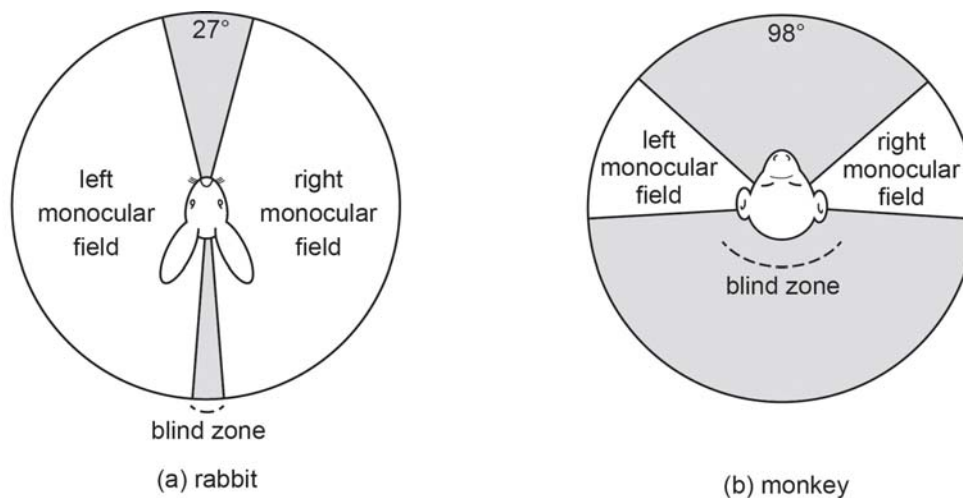
- (d) During the study it was shown that Ross and Richard actually had several different physical traits. Another set of twins in the study, Michelle and Mia, aged three, were found to have hardly any differences in their physical traits. Describe how the theory of epigenetics explains this. (2 marks)

Description	Marks
Changes in the epigenome/ gene expression/ phenotype increase with time	1
The older twins have experienced more environmental differences/the younger twins have experienced less environmental differences	1
	Total 2

Question 34

(9 marks)

Part (a) of this question refers to the diagrams below, which show the vision of a rabbit compared with that of a monkey. (3 marks)



(a) Name the type of vision shown by the monkey.

Compared with the rabbit what advantage does the monkey gain by having this type of vision?

Apart from the type of vision shown in the diagram, describe **one** characteristic associated with vision that the majority of members of the Primate order display.

Description	Marks
Stereoscopic/ binocular/ 3 dimensional vision	1
Better 3-dimensional vision/ better depth perception/ better distance perception	1
Any 1 of the following: <ul style="list-style-type: none">• Colour vision• Increasing proportion of cerebrum devoted to vision• Eyes gradually becoming enclosed in bony sockets	1
	Total 3

(b) Complete the table below, describing the evolutionary trends that occur within the Primate order. (3 marks)

Description		Marks
Characteristic	Evolutionary trend	
Mobility of digits of the hand	<ul style="list-style-type: none">• Increased opposability• Increased dexterity/ mobility• Increased ability to move digits independently of each other• Better precision grip	1
Gestation	<ul style="list-style-type: none">• Increased length of time	1
Shape of molar teeth	<ul style="list-style-type: none">• 3-cusped to 4-cusped to 5 cusped/increase in the number of cusps	1
		Total 3

- (c) It is believed that around 5–6 million years ago, changing climatic conditions in Africa caused change in the landscape. These changes enabled the evolution of an upright stance in the first hominin individuals to occur.

- (i) Describe how the landscape is believed to have changed around 5–6 million years ago. (1 mark)

Description	Marks
Any 1 of the following:	1
<ul style="list-style-type: none"> • Shift from forest to woodland/grassland • Less trees • More open space 	
	Total 1

- (ii) Describe **two** survival or lifestyle advantages that an upright stance had in this new environment. (2 marks)

Description	Marks
Any 2 of the following:	1–2
<ul style="list-style-type: none"> • Hands free for carrying food/ tool use/ tool manufacture/ communication/carrying offspring • Higher reach for collecting food • Improved cooling of the body/decrease SA exposed to sun • Increased range of vision/ seeing greater distance better for detecting predators • Increased size/height better for deterring predators 	
	Total 2

Question 35

(10 marks)

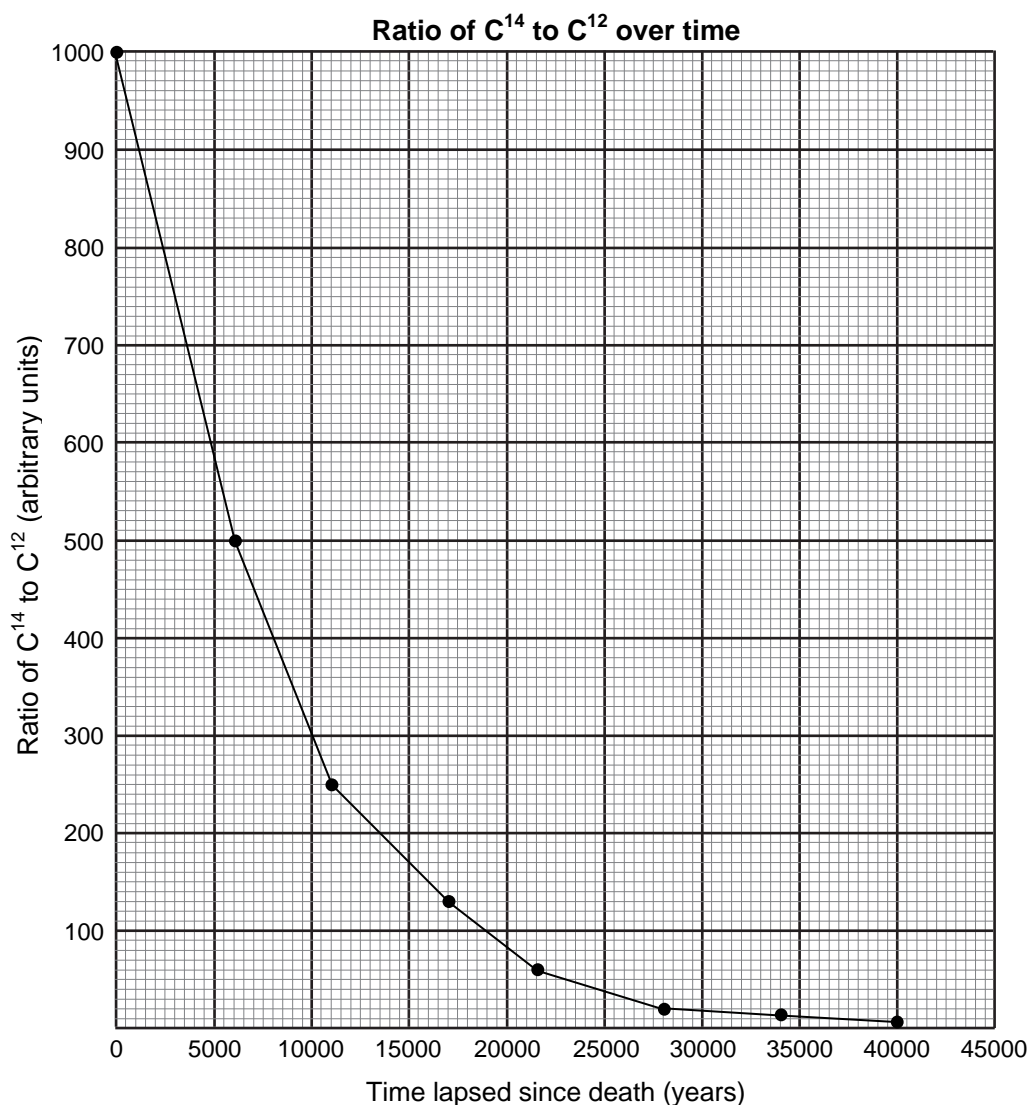
Carbon-14 dating is one commonly used method of fossil dating. The table below shows the ratio of carbon-14 to carbon-12 remaining from the time an organism dies.

Time elapsed since death (years)	Ratio of C ¹⁴ to C ¹² (arbitrary units)
0	1000
5 730	500
11 460	250
17 190	125
22 920	63
28 650	31
34 380	16
40 110	8

- (a) Graph the data from the table on the grid provided below.

(4 marks)

Plot 'Time elapsed since death (years)' on the horizontal axis.



Description	Marks
<i>Maximum of 2 marks for a bar graph</i>	
Correctly plots points and joins points to form a line/ curve	1
Labelling of axes with correct name and unit	1
Uses a suitable scale	1
Title appropriate with both variables included	1
	Total 4

- (b) State whether carbon-14 dating is a form of absolute or relative dating. Explain your answer. (2 marks)

Description	Marks
Absolute	1
Gives an actual date/time (the word 'exact' is not acceptable)	1
	Total 2

- (c) The half-life of C^{14} is 5 730 years. (2 marks)

Define the term 'radioactive half-life'.

Use the data from your graph to estimate the age of a fossil with a ratio of $375 \times C^{14}$ to C^{12} ?

Description	Marks
The time taken for the amount of radiation/ radioactive materials/ carbon 14 (in a sample) to halve.	1
8600 years +/- 200	1
	Total 2

- (d) Two artifacts were found in the same location: a stone tool, which had not been previously disturbed, and a wooden handle. (2 marks)

Name the artifact that could be dated using the carbon-14 technique.

Name a method that could be used to determine the age of the other artifact.

Description	Marks
Wooden handle	1
Relative dating/ superposition/ stratigraphy	1
	Total 2

Question 36

(12 marks)

- (a) The major sources of new variations in a gene pool are mutations. Although they can occur in any cell of the body, mutations occurring in only one type of cell result in changes to allele frequencies in a gene pool. Name the type of cell and describe how mutations in these types of cells can cause changes in allele frequencies in a gene pool. (2 marks)

Description	Marks
Gametes/sex cells/ovum and sperm/ germ line/ germ cell	1
Passed on to the next generation	1
	Total 2

- (b) Members of a single gene pool become isolated from each other, preventing gene flow between the two groups. Eventually the frequencies of two alleles of a particular gene in the two separate gene pools become significantly different from one another.

Explain how natural selection contributes to this difference in allele frequency. (4 marks)

Description	Marks
Any 4 of the following:	
<ul style="list-style-type: none">• Mutation causes variation/ variation within the gene pool• Different selection pressures on different gene pools (populations)/ different environments• A different allele is favoured over the other (in the different environments)/ characteristic more suited to the environment• This characteristic/allele increases in frequency• Due to increased survival/reproduction of individuals with the favoured allele.	1–4
	Total 4

- (c) Name **two** types of barriers to gene flow that may have caused human populations to become isolated from each other in the past. Provide an example of each type. (4 marks)

Description	Marks
Geographical/Physical	1
Examples = oceans/ lakes/ deserts/ mountain ranges/ ice sheets	1
Sociocultural/ cultural/ social	1
Examples = religion/ language/ economic status/ education/ social position	1
	Total 4

- (d) The change in allele frequencies in gene pools is also affected by another evolutionary mechanism called random genetic drift.

Describe **two** ways in which random genetic drift differs from natural selection in its effect on changes in allele frequencies. (2 marks)

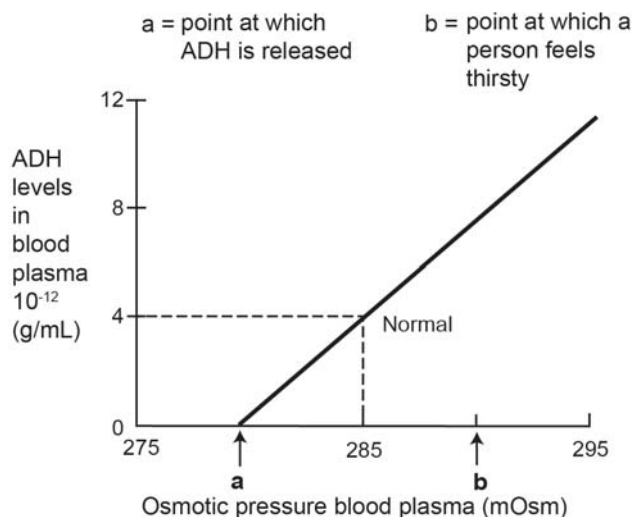
Description	Marks
Any 2 of the following:	
<ul style="list-style-type: none">• Chance occurrence• Non-directional change• No selection pressures/not related to the environment• More likely in small population.	1–2
	Total 2

Question 37

(10 marks)

Part (a) of this question refers to the graph shown below.

The effect of blood plasma osmotic pressure on plasma ADH concentration



The unit mOsm stands for milliosmole or one thousandth of an osmole.

- (a) Given the information in the graph, describe what would be occurring in the kidney to regulate blood fluid composition at a blood plasma osmotic pressure of 285 mOsm. (2 marks)

Description	Marks
Any 2 of the following:	
<ul style="list-style-type: none">• Increase in ADH conc• Distal convoluted tubules/ collecting duct would be more permeable to water• Water being reabsorbed back into the capillaries/ renal capillaries	1–2
	Total 2

- (b) Water intoxication is a condition in which too much water is present in the body. Complete the table below, outlining the effect of water intoxication on the body fluids. (3 marks)

Description		Marks
Changes in bodily fluids	Effect of water intoxication	
Would blood plasma osmotic pressure be above or below normal?	Below	1
Are the intercellular fluids dilute or concentrated?	Dilute	1
Would urine output be increased or decreased?	Increased	1
		Total 3

- (c) Claire is taking part in a scientific study into the effect of exercise on various body systems. Her blood plasma osmotic pressure was checked using a blood sample taken after she exercised strenuously for 30 minutes. It was measured at 292 mOsm.

- (i) Describe **two** processes that would have occurred in her body during exercise to cause this change in blood plasma osmotic pressure. (2 marks)

Description	Marks
Sweating	1
Increased expiration/ breathing rate	1
	Total 2

- (ii) Claire felt thirsty after completing the exercise. In which part of the brain is the centre that triggers the thirst mechanism? (1 mark)

Description	Marks
Hypothalamus	1
	Total 1

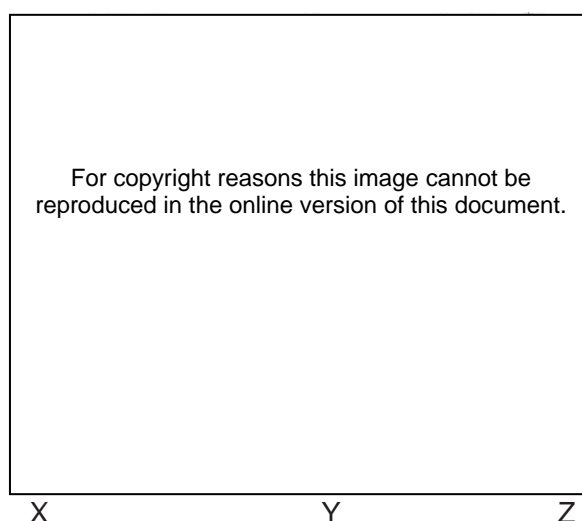
- (iii) How would the information travel from the structure identified in Part (ii) and where would it be processed to make Claire feel that she needed to drink water? (2 marks)

Description	Marks
Nerve impulse/ electrochemical impulse/ nervous transmission/action potential/nerve fibres	1
Cerebrum/ cerebral cortex	1
	Total 2

Question 38

(12 marks)

Part (a) of this question refers to the diagram below, which shows three different types of neurons. (2 marks)



- (a) Identify the neuron which is unipolar.

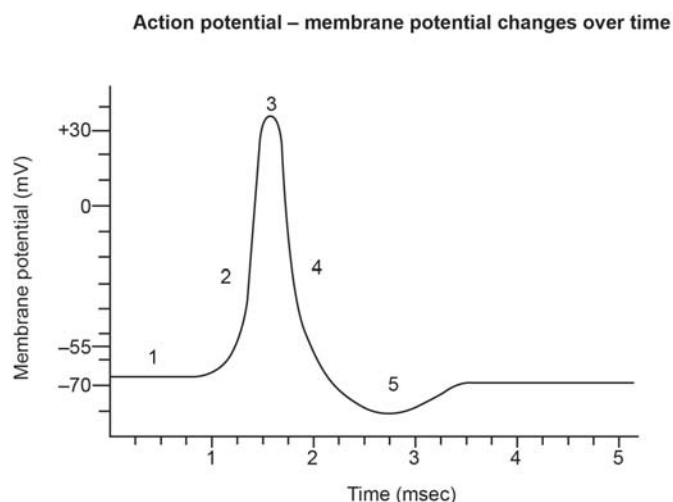
Describe **one** function of the structure shown in the diagram as the myelin sheath?

Description	Marks
Y	1
Any 1 of the following:	1
• Protects the axon/ fibre	
• Acts as an insulator	
• Speeds up transmission of nerve impulses	
	Total 2

- (b) Explain how the transmission of a nerve impulse along a fibre that is myelinated differs from one that is unmyelinated. (2 marks)

Description	Marks
Any 2 of the following:	1–2
• Unmyelinated is continuous/ flows along membrane/ steady depolarisation along the fibre from one point to another	
• Myelinated action potential jumps from one node to another/ saltatory conduction	
• Myelinated is faster than unmyelinated	
	Total 2

Part (c) refers to the graph shown below.



- (c) Complete the table below by indicating the number on the graph corresponding to the point at which the event in the action potential would be occurring. (3 marks)

Description		Marks
Event	Point indicated on graph	
Sodium channels close and membrane is repolarising	4 only	1
Membrane is at resting state	1 only	1
Sodium channels open and membrane is depolarising	2 only	1
		Total 3

- (d) During an action potential, there is a period of time known as the refractory period. (2 marks)

Define refractory period.

On the copy of the graph below, shade the area known as the refractory period.

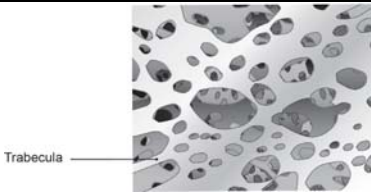
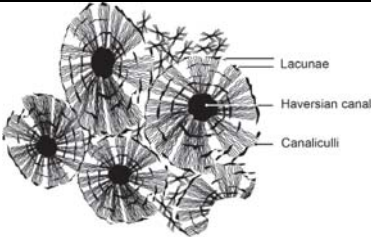
Description		Marks
When a nerve fibre cannot be stimulated again.		1
<p style="text-align: center;">For copyright reasons this image cannot be reproduced in the online version of this document.</p>		1
Shaded area should start at 1 (0.8–1.2) accepted, finish at 3.5 (3.3–3.7) accepted.		
		Total 2

- (e) Action potentials are described as 'all or none responses'. However, it is possible for you to detect the difference between a sheet of paper and a brick being dropped on your foot. Explain why. (3 marks)

Description	Marks
Any 3 of the following: <ul style="list-style-type: none">Action potential remains the same/ nerve impulse is not more intense or weakerMore action potentials are created in a time frame/ increase frequency of action potentialsMore neurons stimulated/ more pain receptors stimulatedCerebrum processes the increased number of action potentialsBecome conscious of a greater degree of pain/ more pain detected	1–3
	Total 3

Question 39**(13 marks)**

- (a) The diagrams below show the two types of bone structure. Complete the table, stating the name, location and a function of each type of bone. (6 marks)

Description			Marks
			1–2
Name	• Cancellous/ spongy	• Compact	
Location	• Heads/ ends of long bones/ epiphysis • Irregular shaped bones • Within flat bones	• Shafts/middle of long bones/ diaphysis • Immediately below cartilage • On surface/ outer layer of most bones	1–2
Function	• Provide strength with lightness • Spaces allow for lightness • Lowers density • Stores red bone marrow • Shock absorption/ elasticity	• Provide strength/ solidness/ support/ rigidity/ stiffness • Provide a cavity for bone marrow	1–2
			Total 6

- (b) A new drug for the treatment of osteoporosis is called Biphosphonate. It works by stimulating osteoblasts and inhibiting osteoclasts in bone.

Outline how osteoclasts and osteoblasts contribute to the change in bone structure.

(4 marks)

Description	Marks
Osteoclasts absorb bone/ phagocytose bone/ break down bone/ decreases density	1
Osteoclasts cause calcium (and phosphate) release from bone	1
Any 2 of the following:	
<ul style="list-style-type: none"> Osteoblasts manufacture bone/ build bone matrix/ build up bone/ deposit more bone on bone surfaces Osteoblasts incorporate calcium (and phosphate) in bone structure Osteoblasts cause bone thickening/ increases density 	1–2
	Total 4

- (c) Osteoarthritis is a disease that is becoming prevalent in many countries. Name **one** type of synovial joint, state one location of the joint in the body and describe the change in function experienced if it is affected by osteoarthritis.

(3 marks)

Description			Marks
Any 1 of the following:			1–3
Type	Location	Pain/can't move /difficulty moving	
Pivot joint	atlas & axis/ in the neck/	head from side to side/ rotation of head	
	arm/ wrist/ forearm/ radius & ulna	rotating/ pronation/ supination of ulna/ radius/ wrist	
Ball and socket joint	shoulder / humerus & scapula/ trapezium	rotating/ moving the arm in any direction	
	hip/ femur & pelvis	rotating/ moving the leg in any direction	
Saddle joint	thumb/ carpal & metacarpal	gripping/ pinching with the thumb and fingers/ extending/ any movement of the thumb	
	sternum & clavicle	any movement of the shoulder	
Hinge joint	humerus & ulna/ radius/ elbow	flexing/ extending forearm	
	femur & tibia/ knee	flexing/ extending knee	
	fingers/ phalanges/ ankle	flexing/ extending fingers/ foot	
Gliding joint	carpal bones/ hand/ wrist	any hand movements	
	tarsal bones/ foot	walking/ weight bearing	
	facet joints of vertebrae/ ribs to vertebrae	bending forward/ backwards/ twisting of spine	
Condylloid joint	metacarpal & phalanges carpal & radius/ hand/ wrist	bending fingers or wrist/ side-to-side wrist action/ flexion/ extension of wrist	
	metatarsals & tarsal/ tarsal & phalanges/ foot	side-to-side foot movements	
	temporomandibular/ lower jaw to cranium	side-to-side jaw movements/ chewing	
			Total 3

Section Three: Extended answer

20% (40 Marks)

Question 40

(20 marks)

- (a) A major role of the cell membrane is to regulate the transport of materials into and out of the cell. One such process is carrier mediated active transport.

Explain how carrier mediated active transport occurs and identify the cell membrane structures involved. (8 marks)

Description	Marks
Any 1 of the following:	1
<ul style="list-style-type: none">Carrier proteins (on surface of/embedded in cell membrane)Pumps/ ion pumps	
Any 7 of the following:	1–7
<ul style="list-style-type: none">movement of substances from low to high concentrations/ movement against a concentration gradient	
<ul style="list-style-type: none">requires energy	
<ul style="list-style-type: none">energy is in the form of ATP	
<ul style="list-style-type: none">carrier proteins/ pumps are specific	
<ul style="list-style-type: none">carrier protein binds to a ion/ molecule	
<ul style="list-style-type: none">protein changes shape	
<ul style="list-style-type: none">moves ion/ molecule to other side of cell membrane	
<ul style="list-style-type: none">carrier proteins can be saturated/ are limited in amount they can transport/ if all occupied cannot increase transportation	
<ul style="list-style-type: none">can also involve co-transport/ anti-transport	
<ul style="list-style-type: none">co-transport involves the simultaneous movement of two substances in opposite directions	
<ul style="list-style-type: none">regulated by substances such as hormones	
	Total 8

- (b) DNA codes for the production of proteins in a cell through a series of processes.

Describe these processes in sequence from the coding by DNA to the production of a protein and explain why every protein is different in structure. (12 marks)

Description	Marks
Protein Production	1–5
Any 5 of the following:	
• transcription	
• DNA double helix is broken/ bond breaks/ unwinds/ separate between base pairs	
• DNA broken by RNA polymerase/Helicase	
• mRNA/ pre-mRNA is formed	
• T replaced by U	
• mRNA is a coding/ complementary strand/ pair rule	
• introns/ excess bases removed	
• mRNA moves from nucleus to ribosome/ mRNA moves through the nuclear membrane	
Any 5 of the following:	1–5
• translation	
• ribosome attaches to one end of the mRNA	
• ribosome reads the code	
• codons/ triplet consist of 3 mRNA bases	
• 3 mRNA bases determine one amino acid	
• start codon is AUG/ all proteins start as methionine	
• tRNA brings amino acids to ribosome	
• tRNA contains anticodons/ has complementary nucleotides to mRNA	
• ribosome joins amino acids together	
• polypeptide chain/peptide bonds formed	
Why different?	1–2
Any 2 of the following:	
• codon/ triplet is made up of different combination of bases producing different amino acids	
• different combinations of amino acids produce different proteins	
• a section of DNA (called a gene) determines which protein/ polypeptide chain is made	
• proteins are different in structure because they perform many specific functions/ provide an example of function	
	Total 12

Question 41

(20 marks)

(a) State a major function of each of the following parts of the central nervous system.

- i. Cerebrum
- ii. Cerebellum
- iii. Hypothalamus
- iv. Medulla Oblongata
- v. Spinal Cord

(5 marks)

Description	Marks
Cerebrum <ul style="list-style-type: none">Higher order functions/ thinking/ reasoning/ memory/ learning/ consciousness/ association/ speech/ any correct exampleSensory perception/ processing/ hearing/ sightConscious motor control	1
Cerebellum <ul style="list-style-type: none">Coordination of muscle movements/ involuntary control of skeletal muscle/ fine tuning of muscle movements/ ensures movements match intended movementsMaintaining posture and balanceMuscle tone	1
Hypothalamus <ul style="list-style-type: none">Homeostasis/ regulation of autonomic bodily functions eg. water, temperatureAppetite/ thirst/ food intakeBody temperature regulation/ regulation of heart/ regulation of cardiac output/ regulation of digestionResponses to fear or angerControl of pituitary hormones and their functionsMetabolismMenstrual cycleAdrenal medulla for secretion of adrenaline	1
Medulla Oblongata <ul style="list-style-type: none">Regulates heart/ cardiac outputRegulates breathingRegulates diameter of blood vessels/ vasomotor controlProtective reflexes/ any correct example	1
Spinal Cord <ul style="list-style-type: none">Communicates between brain and organs/ glands/ muscles/PNSProtective reflexes/ automatic reflexes	1
	Total 5

- (b) Both Alzheimer's disease and Parkinson's disease are conditions affecting the central nervous system. Neither of these conditions currently has a cure.

- i. Outline how Alzheimer's disease and Parkinson's disease affect the brain.
(4 marks)

Description	Marks
Alzheimer's disease Any 2 of the following: <ul style="list-style-type: none">• Build-up of protein/ plaques and tangles in the brain• (Resulting in) degeneration of nerve cells/ pathways/ shrinkage of the brain/ decreases acetylcholine• Memory loss/ confusion/ mood swings/ aggression	1–2
Parkinson's disease Any 2 of the following: <ul style="list-style-type: none">• Degeneration of nerve cells in the brain• (Resulting in) a loss of dopamine/ dopamine receptors/ dopamine neurons/ dopamine synapses• Shaking/ slow movement/ impaired speech/ tremor	1–2
	Total 4

- ii. Research into the treatment of diseases like Alzheimer's disease and Parkinson's disease is often focused on stem cell therapy. Describe how embryonic stem cell therapy could be used to treat diseases of the nervous system.
(11 marks)

Description	Marks
Any 11 of the following: <ul style="list-style-type: none">• Fertilised egg matures until it reaches blastocyst stage/ 8 cells• (blastocyst) cells are harvested/ removed• cells taken from the inner cell mass• stem cells are unspecialised cells• stem cells are capable of differentiating into specific cell types/ stem cells are pluripotent• cells may be obtained from stem cell bank• cells stimulated with growth factors• cells mature into adult nerve cells• cells can be cloned• nerve cells are then injected back into patient• new cells replace damaged nervous tissue• new cells repair/ regenerate damaged nervous tissue• symptoms of disease reduced• nerve cells can be studied in the laboratory• cells studied to see how they respond to potential new drugs	1–11
	Total 11

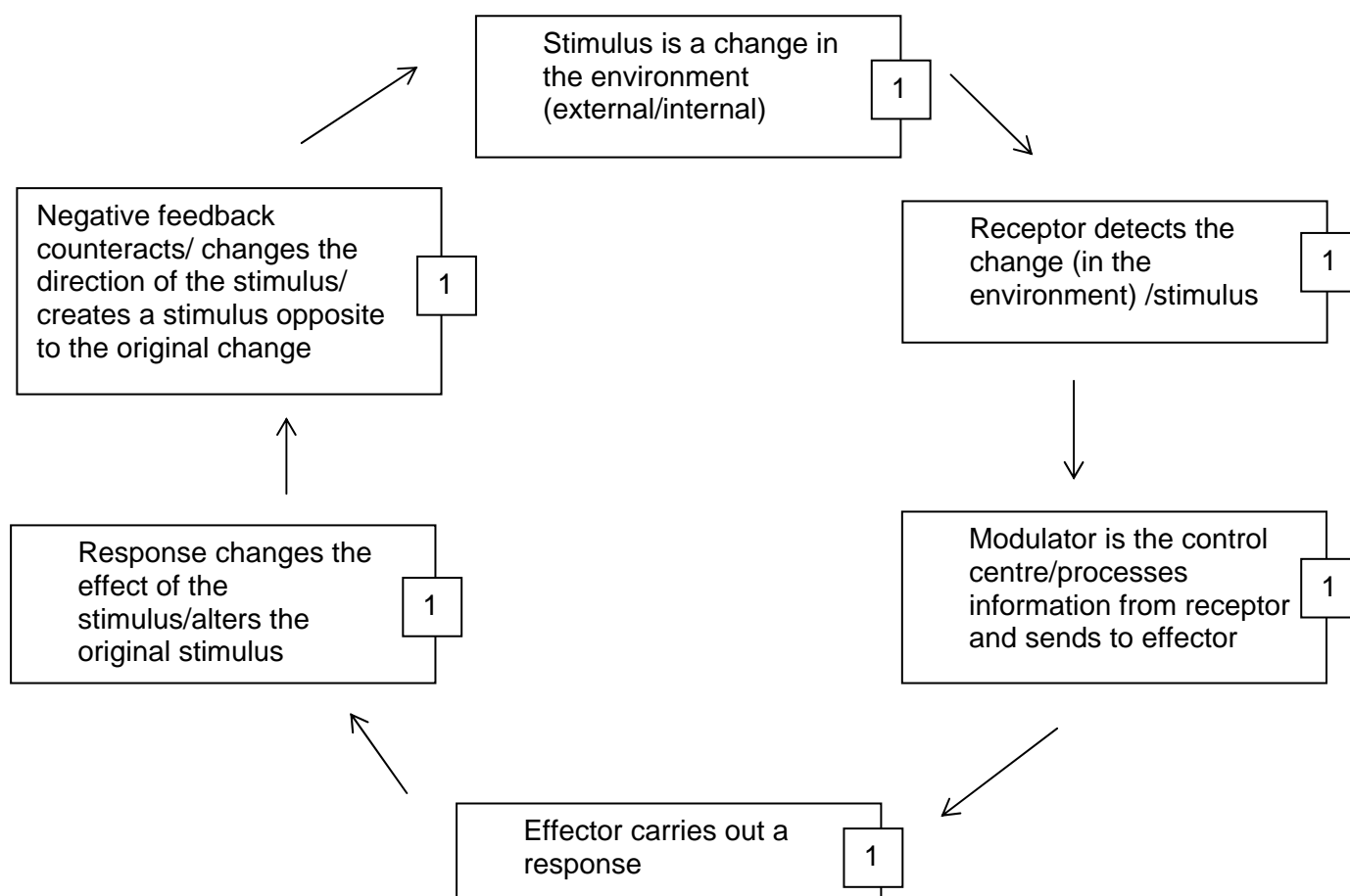
Question 42

(20 marks)

The internal environment of the human body must be maintained within narrow tolerance limits.

- (a) Describe the functions of each component of a negative feedback model in maintaining the body's internal environment within these limits. (6 marks)

Description	Marks
Stimulus is a change in the environment (external/internal)	1
Receptor detects the change (in the environment) / stimulus	1
Modulator is the control centre/ processes/ regulates information from receptor and sends to effector	1
Effector carries out a response	1
Response changes the effect of the stimulus/alters the original stimulus	1
Negative feedback counteracts/ changes the direction of the stimulus/creates a stimulus opposite to the original change	1
Total 6	

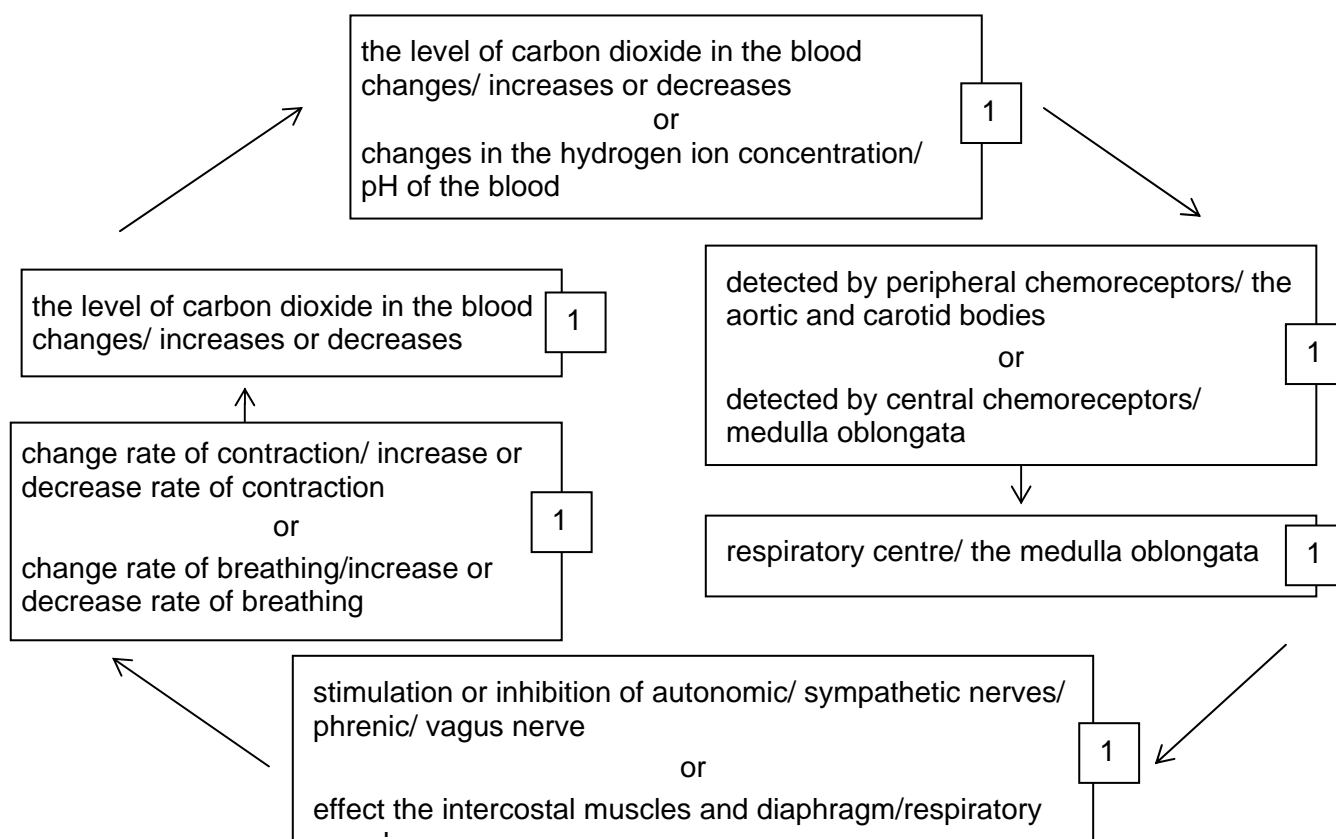


- (b) A patient was in a coma for a long period due to damage to his cerebrum. However, he was able to maintain some functions, such as breathing and maintenance of blood pressure, within the normal tolerance limits without the use of medical intervention.

Using your knowledge of the functions of the brain and negative feedback models, explain how he was able to continue to breathe normally and control his blood pressure even though part of his cerebrum was damaged. (14 marks)

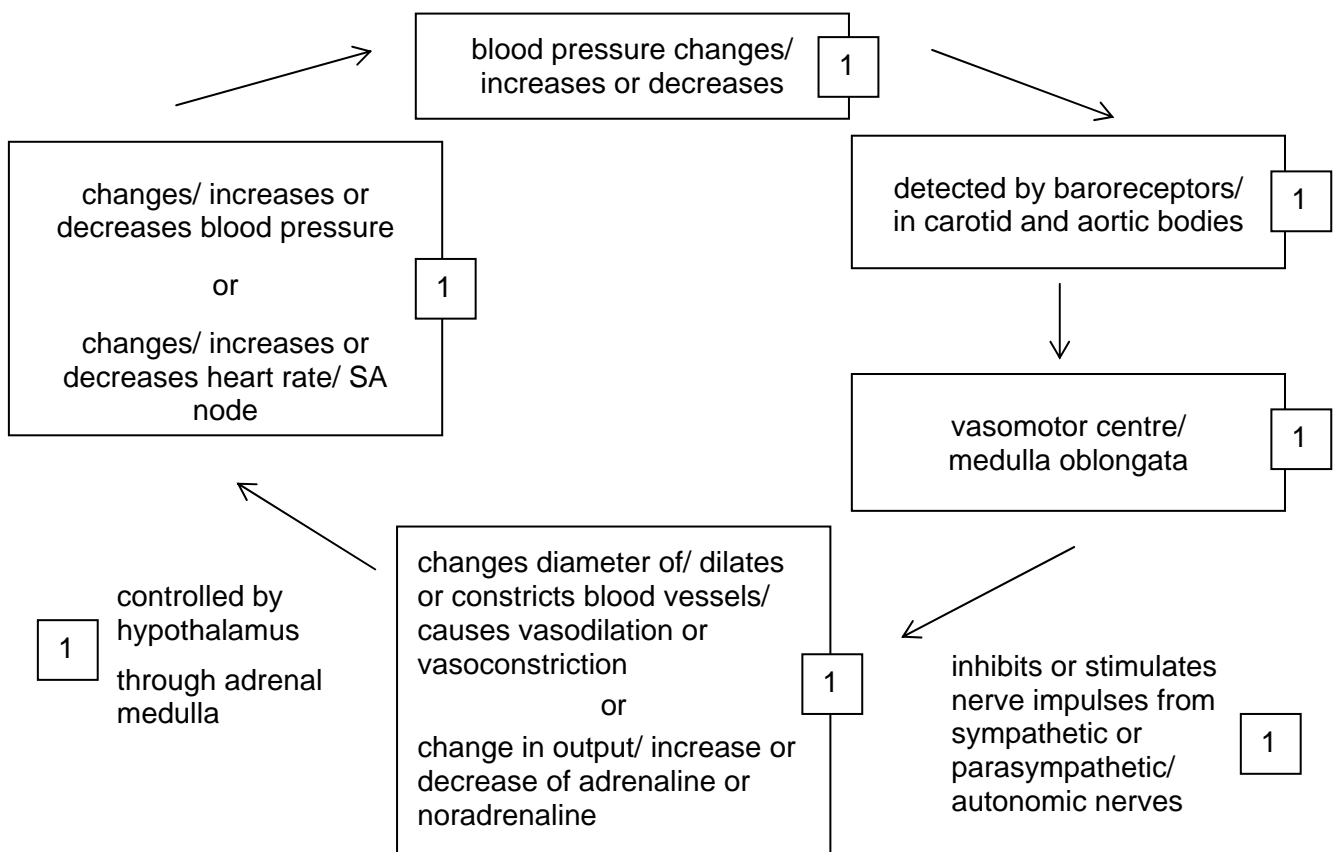
Description	Marks
<ul style="list-style-type: none"> the cerebrum is not involved (in the control of breathing and blood pressure) breathing and blood pressure are controlled by the medulla and not affected by damage to the cerebrum 	1
Breathing	
<ul style="list-style-type: none"> the level of carbon dioxide in the blood changes/increases or decreases changes in the hydrogen ion concentration/pH of the blood 	1
<ul style="list-style-type: none"> detected by peripheral chemoreceptors/the aortic and carotid bodies detected by central chemoreceptors/medulla oblongata 	1
respiratory centre/ the medulla oblongata	1
<ul style="list-style-type: none"> stimulation or inhibition of autonomic/sympathetic nerves/ phrenic/ vagus nerve effect the intercostal muscles and diaphragm/respiratory muscles 	1
change rate of contraction/increase or decrease rate of contraction	1
<ul style="list-style-type: none"> change rate of breathing/increase or decrease rate of breathing negative feedback/the level of carbon dioxide in the blood changes/increases or decreases 	1

Breathing



Description	Marks
Blood pressure	
• blood pressure changes/increases or decreases	1
• detected by baroreceptors/carotid and aortic bodies	1
• vasomotor centre/medulla oblongata	1
• Inhibits or stimulates nerve impulses from sympathetic or parasympathetic/autonomic nerves	1
• changes diameter of/dilates or constricts blood vessels/ causes vasodilation or vasoconstriction	1
• change in output/increase or decrease of adrenaline or noradrenaline	
• controlled by hypothalamus	1
• through adrenal medulla	
• changes/increases or decreases heart rate/ SA node	1
• negative feedback/changes/increases or decreases blood pressure	
	Total 14

Blood Pressure



ACKNOWLEDGEMENTS

Section Two

Question 31(b) Adapted from: *The actions of antibodies on pathogens* [Diagram]. Retrieved January, 2012, from <http://leavingbio.net/The%20Human%20Defence%20System-web-2.htm>.

Question 34(a) Adapted from: Comparison of the vision of a monkey and a rabbit [Figure 3]. In J.W. Bradbury, & S.L. Vehrencamp. (1998). *Principles of animal communication*. Sunderland, MA: Sinauer Associates. Retrieved January, 2012, from <http://openlearn.open.ac.uk/mod/oucontent/view.php?id=398764§ion=3.4>.

Question 37(a) Diagram adapted from: Lote, C. Water balance. In C. Blakemore, & S. Jennett. (Eds.). (n.d.). *Oxford companion to the body*. Oxford/New York: Oxford University Press. Retrieved January, 2012, from www.answers.com/topic/water-balance-1.

Questions 38(a) and (b) Adapted from: *Motor neurons* [Diagram]. Retrieved January, 2012, from www.tutorvista.com/content/biology/biology-iv/nervous-coordination/neurons-types.php.

Question 38(d) and € Adapted from: *Action potential – membrane potential changes over time* [Graph]. Retrieved January, 2012, from <http://starklab.slu.edu/PhysioLab/NKPhysioNervesAnswerKey.htm>.

Question 39(a) Adapted from: Bone structure 1 [Diagram]. In *Mosby's medical dictionary* (8th ed.). St Louis, MO: Mosby/Elsevier. Retrieved February, 2012, from <http://medical-dictionary.thefreedictionary.com/>.

Adapted from: Gray, H. (1913). Bone structure 2 [Diagram]. In *Gray's anatomy: Descriptive and applied*. Philadelphia: Lea & Febiger, p. 38. Retrieved February, 2012, from www.biog1105-1106.org/.