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| C:\Users\s.kanakis\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Word\ACC Logo_L_rgb_lrg.jpg | **Aranmore Catholic College**  **Mock Examination, 2012**  **Question/Answer Booklet** |

Please place your student identification label in this box

HUMAN BIOLOGICAL SCIENCE

**Stage 3A/3B**

Student Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student’s Teacher \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### Time allowed for this paper

Reading time before commencing work: ten minutes

Working time for paper: three hours

**Materials required/recommended for this paper**

To be provided by the supervisor

This Question/Answer Booklet

Multiple-choice Answer Sheet

***To be provided by the candidate***

Standard items: pens, pencils, eraser, correction fluid, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

**Important note to candidates**

No other items may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non‑personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor before reading any further.

**Structure of this paper**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Section | Number of questions available | Number of questions to be answered | Suggested working time (minutes) | Marks available | Percentage of exam |
| SECTION ONE:  Multiple-choice | 30 | 30 | 40 | 30 | 30 |
| SECTION TWO:  Short answer | 9 | 9 | 90 | 100 | 50 |
| SECTION THREE:  Extended answer | 3 | **2** | 50 | 40 | 20 |
|  |  |  |  |  | 100 |

**Instructions to candidates**

1. The rules for the conduct of examinations at Aranmore are detailed in the *Examination Information Handbook 2012.* Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

* + Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
  + Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

**Section One: Multiple-choice 30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square; do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

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1. Homeostasis is the

(a) lowering of body temperature by sweating.

(b) secretion of hormones from endocrine glands.

(c) excretion of nitrogenous wastes in urine.

(d) maintenance of a constant internal environment.

2. Core body temperature

(a) is usually increased by sweating.

(b) is reduced by vasoconstriction in arterioles of the skin.

(c) can be increased by radiation on a very hot day.

(d) is reduced by shivering.

3. Hypothyroidism

(a) is a result of an overactive thyroid gland.

(b) results in an enlarged thyroid gland.

(c) would be treated by the surgical removal of part of the thyroid.

(d) results in fatigue, weight loss and an inability to deal with the cold.

4. Which of the following is a correct statement?

(a) The pancreas secretes glucagon to reduce blood glucose levels.

(b) Parathyroid glands release ACTH to control potassium and sodium levels in the blood.

(c) The adrenal cortex releases cortisol and adrenalin.

(d) The interstitial cells of the testes produce testosterone.

5.The efferent division of the nervous system

(a) is part of the central nervous system.

(b) conducts messages towards the brain and spinal cord.

(c) is further subdivided into the autonomic and somatic divisions.

(d) only innervates smooth muscle, cardiac muscle and glands.

6. One particular snake venom binds with acetylcholine at the synapse. As a result of this, the venom would

(a) prevent the nerve impulse from being transmitted across the synapse.

(b) ensure the nerve impulse is repeatedly transmitted across the synapse.

(c) block an inhibitor from filling the receptors on the post synaptic membrane.

(d) prevent the release of acetylcholine from the surface of the presynaptic knob.

7. A polygenic condition

(a) produces only two phenotypes.

(b) results in a range of phenotypes.

(c) includes skin colour and sickle cell anaemia.

(d) is a result of limited gene flow.

8. In some parts of the world, such as Ireland, where dairy farming has been occurring for thousands of years, the incidence of lactose intolerance is about 5%. In South East Asia, where dairy farming does not occur, the incidence is 95%. This is an example of

(a) natural selection.

(b) random genetic drift.

(c) founder effect.

(d) a specific mutation in the population.

9. Which of the following situations does NOT result in a change in allele frequencies in a population?

(a) mutation

(b) founder effect

(c) geographical barriers

(d) speciation

10. It is difficult for specimens to become fossils if

(a) minerals move into them over time.

(b) they are surrounded by alkaline soil conditions.

(c) they are not covered by sedimentary soils.

(d) animals deliberately bury them.

11. Index fossils, such as trilobites, are useful fossils as they

(a) give some indication of the environmental conditions of the time.

(b) are wide spread and different species only existed for a short period of time.

(c) have not changed their appearance over an extended period of time.

(d) are found in volcanic material and can be aged using potassium argon dating.

**The next TWO questions refer to the diagram below.**



12. The youngest and oldest layers are, in order,

(a) Q1 and R7.

(b) P1 and Q6.

(c) R1 and P6.

(d) Q1 and P6.

13. The dating technique shown in the diagram above

(a) demonstrates a relative dating technique as it gives the age in years.

(b) can’t be used to compare core samples from different sites.

(c) is adversely affected by geological disruptions such as faults.

(d) relies on the youngest layer being put down first.

14. In a sample of DNA there were 120 guanine bases and 180 thyamine bases. The total number of nitrogen bases in this sample of DNA would be

(a) 120.

(b) 180.

(c) 300.

(d) 600.

15. How is the control of cardiac muscle unique?

(a) It is not affected by the action of hormones.

(b) It can initiate its own contractions.

(c) It only involves nervous control.

(d) It is controlled by adrenalin.

16. Smooth muscle is different to skeletal muscle in that smooth muscle

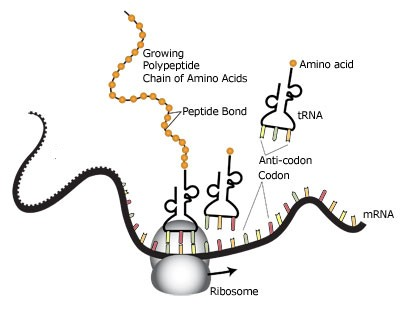
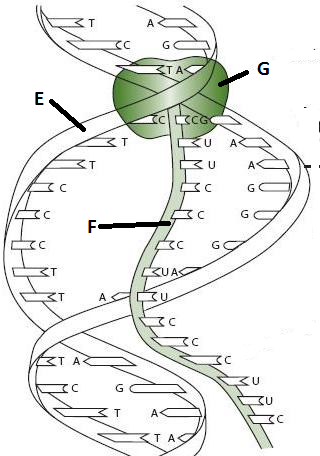
(a) is under involuntary control.

(b) does not require ATP for muscle contractions to occur.

(c) receives impulses from the somatic nervous system to initiate contraction.

(d) does not involve the sliding filament model.

**The next THREE questions refer to the diagrams below that show two parts of a process occurring inside a cell.**



Stage A Stage B

17. Which of the following statements about the process, indicated in the diagrams above, is correct?

(a) Stage A is transcription as the mRNA is being converted to DNA.

(b) Stage A is transcription as the code on the DNA is being copied onto mRNA.

(c) Stage B is transcription as the mRNA is being converted to DNA.

(d) Stage A is translation as the mRNA is being converted to DNA.

18. Structure E and structure F are different because structure F

(a) contains thyamine not uracil.

(b) is double stranded not single stranded.

(c) is constructed from deoxyribose sugars not ribose sugars.

(d) leaves the nucleus, unlike structure E.

19. Structure G

(a) is a DNA ligase molecule.

(b) first binds to a promoter gene on the DNA.

(c) results in the modification of mRNA to only contain exons.

(d) uses nucleotides from the cytoplasm to form a tRNA chain.

**The NEXT question refers to the image below.**



20. Which type of organelle would these muscle cells need in large amounts to function?

(a) ENR

(b) Nuclei

(c) Mitochondria

(d) Golgi bodies

21. Cartilage

(a) is made up of haversian systems.

(b) provides points of attachment for muscles.

(c) contains fibres of collagen to provide strength and flexibility.

(d) contains blood vessels which speeds its rate of healing.

22. Often a number of hormones can be involved in maintaining the same aspect of homeostasis. Which of the following is correct?

(a) Parathyroid hormone and aldosterone regulate the amount of calcium in the blood.

(b) Adrenalin, glucagon and insulin regulate the glucose level of the blood.

(c) Thyroxine and ACTH helps maintain salt and water balance in the body.

(d) Cortisol and ADH decrease the rate of oxygen use by some cells.

**The next TWO questions refer to the diagram below.**



23. This joint

(a) is a cartilaginous joint as there is articular cartilage present on the ends of the bone.

(b) has a complete range of movement because it is a fibrous joint.

(c) is the elbow joint as it is a ball and socket joint.

(d) relies on articular cartilage and synovial fluid to reduce friction in the joint.

24. This person was shown to have very little articular cartilage or synovial fluid at this joint. Therefore, this person

(a) would be diagnosed with osteoporosis.

(b) will most likely require joint replacement surgery.

(c) would require stem cell therapy to replace the lost fluid.

(d) would be more prone to fractures in this area.

25. All primates share

(a) a small cerebral cortex and greater emphasis on vision.

(b) longer gestation times and shorter periods of parental care.

(c) a reduction in prognathism and a broad short pelvis.

(d) greater mobility of their digits and a reduction in reliance on smell.

26. Homo habilis and Homo erectus

(a) both used fire.

(b) both lived in Africa and Europe.

(c) used tools for chopping and scraping.

(d) created portable and mural artworks.

27. The following is a list of cultural advances seen in our ancestors.

1. burial of the dead
2. use of oldowan tools
3. grew crops
4. use of bone and antler for tools
5. used fire
6. tended animals

Which of these cultural advances was seen in Homo habilis

(a) ii) and iii)

(b) iv) and vi)

(c) v) and vi)

(d) ii) only

28. The agricultural revolution

(a) resulted in a reduction in selective pressures from seasonal climate change .

(b) caused population groups to get smaller.

(c) reduced the time available to develop tools.

(d) was solely reliant on the grazing of cattle.

29. The following shows a number of cultural developments that occurred over time. Which of the following developments shows the correct order in which these advances occurred?

(a) stone tools, use of fire, growing crops

(b) use of fire, bone tools, growing crops

(c) use of fire, bone tools, art

(d) use of clothing, stone tools, spiritual beliefs, art

30. Which of the following would be a reason to continue the development of genetic probes?

(a) provides an improved diagnosis of genetic diseases

(b) leads to the development of customised drugs according to a person’s genetic profile

(c) matches potential organ donors to recipients

(d) improves the study of migratory patterns of humans over evolutionary time

**End of Section One**

**Section Two: Short answer 50% (100 Marks)**

This section has **nine** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. As is a spare graph grid. They can be used for planning your responses and/or as additional space if required to continue your answer.

* Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
* Continuing your answer: if you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

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**Question 31. (11 marks)**

“Whooping cough beats vaccine,” screamed the headline in the West Australian in March this year. Data given by the article indicated that by March 10th this year, over 1193 cases of whooping cough had been reported in Western Australia, compared to 374 at the same time last year and 139 in 2010. Scientists believe that the epidemic is due to a new resistant strain of whooping cough bacteria. It is believed that 10 years ago, this new strain was responsible for 31% of all the cases of whooping cough, however, this is now up to 84% of the cases being seen around the country, indicating it has gained a selective advantage in the environment.

(a) What would be contained in the whooping cough vaccine? (1 mark)

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(b) What type of immunity would this vaccine offer? (1 mark)

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(c) Provide one reason for the development of the new strain of bacteria. (1 mark)

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(d) Describe how a child’s immune response would vary if they were exposed to the strain they

had been vaccinated against, compared with being exposed to this new strain for the first time. (4 marks)

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(e) Vaccines can be created using recombinant DNA techniques. Explain how each of the following are involved in that technique: (4 marks)

(i) recognition sequence.

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(ii) restriction enzymes. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(iii) DNA ligase. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(iv) plasmids.

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**Question 32. (17 marks)**

WA paramedics are about to take part in a national study to see if injecting heart attack patients with chilled saline solution improves their chances of survival. Scientists are conducting the study on 2500 patients in WA, South Australia and Victoria over the next three years. In the preliminary trial conducted over 3 months, some heart attack patients on their way to hospital in an ambulance were given intravenous cooling fluids to lower their core body temperature by about four degrees to 33oC and their survival rates were recorded. Other heart attack patients were treated by the current method. That is, taken to emergency departments where they were resuscitated until their pulse returned, before being given the cooled saline solution.

(a) What hypothesis could the scientists have been testing? (1 mark)

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(b) What would be the independent variable? (1 mark)

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(c) Name two variables that should be controlled in the preliminary trial. (2 marks)

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(d) What would be the control group in the preliminary trial and how should individuals for this group be chosen? (2 marks)

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(e) Name one ethical concern that must have been considered prior to the approval being given for this study. (1 mark)

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(f) Suggest the advantages of carrying out a blind or double blind study in any investigation.

(2 marks)

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The preliminary trial data for 50 subjects is shown in the table below.

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| --- | --- | --- | --- | --- | --- |
|  | Time elapsed before cold saline is injected (mins) | | | | |
| 1 | 5 | 10 | 30 | 50 |
| Number of subjects | 1 | 13 | 15 | 17 | 4 |
| Average chance of survival  (%) | 100 | 70 | 60 | 25 | 5 |

(g) Graph the results from the table on the grid provided below to show the effect of injecting

cooled saline at different times on one’s chance of survival. There is a spare grid at the end of the answer booklet if you want to redraw this graph. Please indicate if you are going to use it. (5 marks)

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(h) State one limitation seen in the data. (1 mark)

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(i) What conclusion could be made from the data? (1 mark)

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(j) How have the scientists improved their methodology from the preliminary trial to the national study? (1 mark)

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**Question 33. (12 marks)**

In 1990, when a house-buyer dug up the patio of his new residence, he found a skeleton wrapped up in a carpet. Facial reconstruction from the skull was put out to the press and someone phoned Crimewatch and suggested it was Karen Price, a young woman who had gone missing 10 years previously. DNA was extracted from the skeleton and compared to the DNA of Karen’s mother and father; it was indeed their daughter. The subsequent investigation resulted in the identification of a suspect who was the first ever person convicted using evidence gathered from the use of PCR.

(a) Why would PCR evidence have been required in this case? (1 mark)

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(b) Describe how the process of PCR is carried out. (6 marks)

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(c) (i) By what process would the DNA of Karen and her parents have been compared?

(1 mark)

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(ii) What evidence would have shown Karen was their daughter? (1 mark)

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(d) What features of the pelvis and foot of the skeleton would have suggested this individual was a hominin? (3 marks)

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**Question 34. (8 marks)**

The flowchart below summarises the regulation of water in the blood.

Optimum osmotic pressure

Osmotic pressure falls Osmotic pressure rises

More ADH released Less ADH released

More water reabsorbed from Less water reabsorbed from

the kidneys the kidneys

Osmotic pressure rises Osmotic pressure falls

Optimum osmotic pressure

(a) What receptors detect the change in osmotic pressure? (1 mark)

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(c) How is ADH carried to the kidneys? (1 mark)

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(d) What is the modulator in this feedback model? (1 mark)

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(e) Explain why this flowchart depicts a negative feedback mechanism and suggest why most feedback systems in the human body are of this type. (2 marks)

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(f) Alcohol inhibits the release of ADH. Suggest how alcohol consumption would affect urine volume and concentration. (2 marks)

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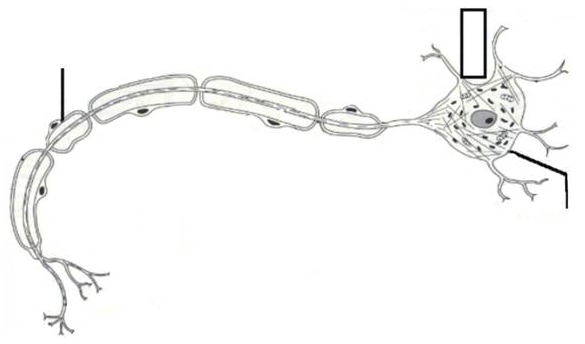
**Question 35. (12 marks)**

(a) State differences between the structure and function of a sensory and connector neuron.

(4 marks)

|  |  |  |
| --- | --- | --- |
|  | Sensory Neuron | Connector Neuron |
| Structure |  |  |
| Function |  |  |

(b)



A

B

(i) State the function of structure A. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

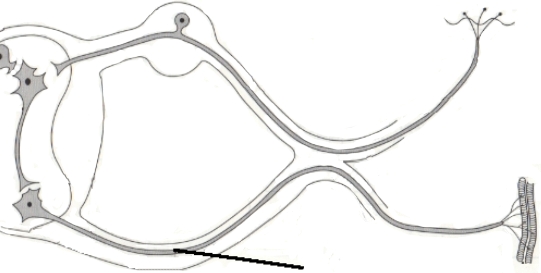
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(ii) Name one place structure B would be found. (1 mark)

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(iii) Draw an arrow in the box provided in the diagram above, to show the direction a nerve impulse would travel through this neuron. (1 mark)

(c)



A

1. Onto the diagram use an arrow to show the path of nerve impulses.

(1 mark)

(ii) What would be the effect of an injury that prevented the nerve impulse passing through structure A? (1 mark)

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(iii) Some people are born without free nerve endings that detect pain. How would this affect the functioning of the reflex arc? (1 mark)

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(iv) The nervous system communicates rapidly whilst the endocrine system does so more slowly. With reference to the diagram above, explain the advantage such a dual system offers. (2 marks)

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**Question 36. (9 marks)**

(a) Complete the table below that compares and contrasts B cells and T cells. (4 marks)

|  |  |  |
| --- | --- | --- |
|  | B cell | T cell |
| Where they are initially produced |  |  |
| Where they mature |  |  |
| How they come into contact with an antigen |  |  |
| Main mechanism of response |  |  |

(b) Both B cells and T cells produce memory cells when they are activated. What advantage do these memory cells offer? (2 marks)

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(c) Describe three ways that antibodies are believed to act against non-self cells. (3 marks)

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**Question 37. (10 marks)**

(a) (i) George decided to take a hot bath. As his temperature increased in the hot bath, his

high blood pressure decreased. Use a feedback model to explain how this reduction in blood pressure may have come about. (6 marks)

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(ii) George has fair skin. While relaxing in the hot bath, he noticed that his skin seemed to become slightly more red. Explain to George why this would also happen. (3 marks)

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(iii) George spent most of his time reading his novel while in the bath. What division of the peripheral nervous system would he have used to allow him to turn the page of his book? (1 mark)

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The following information is about how the blood in the small intestine absorbs glucose from the food passing through it.

“The blood absorbs glucose and some other molecules from the small intestine. Glucose molecules are the same size as the other molecules, however, glucose molecules are absorbed more quickly. As well, the uptake of oxygen from the blood into the small intestinal cells is much greater when glucose is present in the small intestine. Small intestine cells are packed with mitochondria.”

(a) Using the information above, explain the evidence that suggests that glucose is actively absorbed from the small intestine. (3 marks)

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(b) Explain why blood glucose decreases if a person exercises more than usual.

(2 marks)

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(c) Explain why sugar rather than starch is given to a diabetic in a hypoglycaemic attack.

(2 marks)

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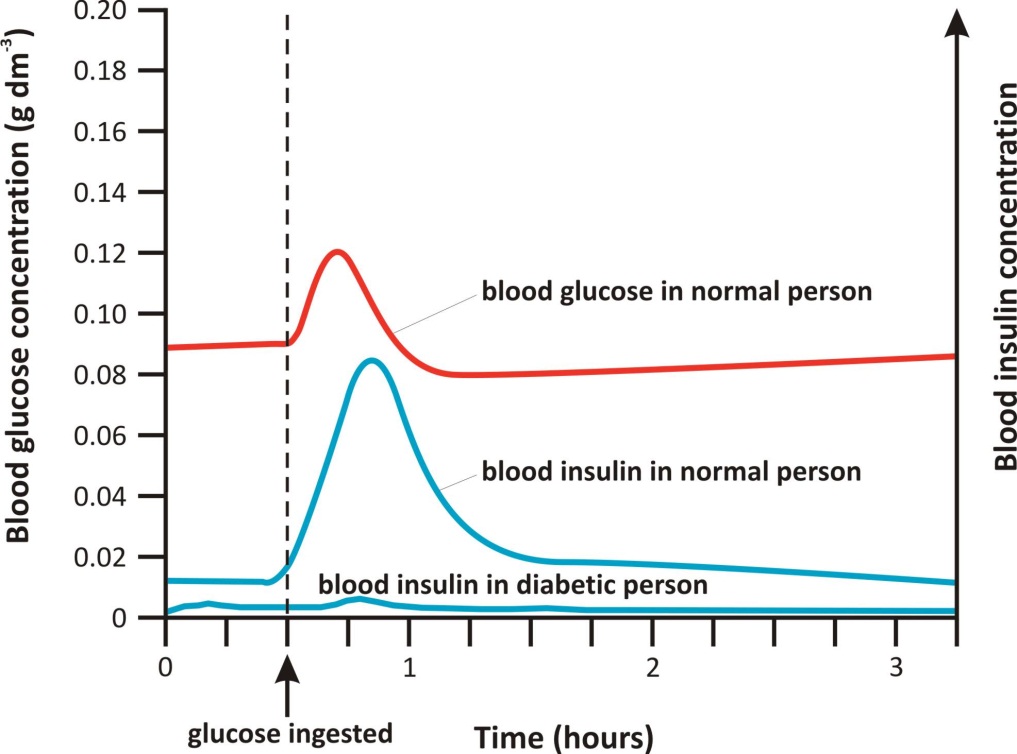
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(d) On the graph below, **sketch** the **line** of the blood glucose concentration you would expect

to see in a diabetic person. (1 mark)



**Question 39. (13 marks)**

DNA is believed to be the greatest single achievement of nature to date, yet its interactive relationship with the environment in which it lives is only now coming to be understood.

(a) Using skin colour as the example, explain how DNA and the environment will both impact on the phenotype of the individual. (2 marks)

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(b) Once it was believed that DNA could not be altered in the living organism. The study of epigenetics has changed that belief.

(i) Give a definition for epigenetics . (2 marks)

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(ii) Give two possible long term outcomes of the Human Genome Project.

(2 marks)

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(c) Define mutation and explain, using an example, why not all mutations need be harmful.

(3 marks)

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(d) Both DNA and proteins can be used to support the theory of evolution.

1. Explain how comparative studies, like these, support the theory of evolution.

(1 mark)

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(ii) Which of these two comparative studies (DNA or proteins) would provide more accurate information to support the theory of evolution? Explain your answer. (3 marks)

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**End of Section Two**

**Section Three: Extended answer 20% (40 Marks)**

This section contains **three (3)** questions. You must **Answer Only two (2)** questions. Write your answers in the space provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

* Planning: if you use the spare pages for planning, indicate this clearly at the top of the page.
* Continuing your answer: if you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Responses could include clearly labelled diagrams with explanatory notes; lists of points with linking sentences; labelled tables and graphs; annotated flow diagrams with introductory notes.

Suggested working time: 50 minutes.

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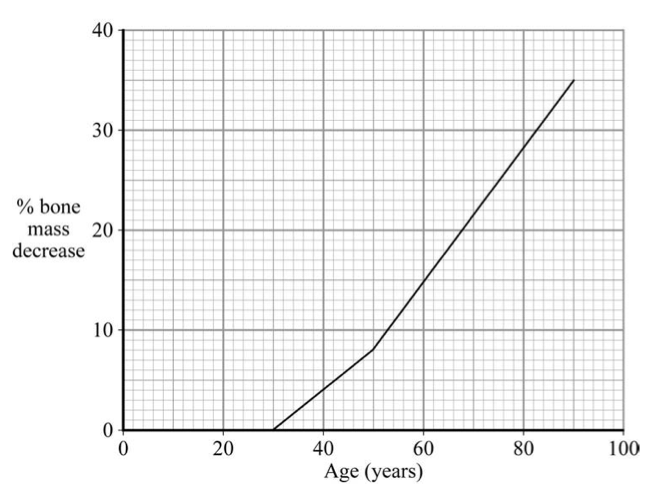
**Question 40. (20 marks)**

(a) Carbon dioxide levels increase as a result of increased rates of cell respiration. Describe the homeostatic process whereby gas concentrations are returned to optimal levels. (7 marks)

(b) One of the cultural trends seen in Hominins is the increased complexity of tool culture. What is the earliest known stone tool culture seen in Hominins. Describe what this earliest type of tool looked like and the earliest Hominin it is associated with. What tool culture followed this earliest tool culture? How was it different from the earlier tool culture?

(5 marks)

(c) Peak bone mass occurs in women at age 30. After this time, bone mass decreases as shown in the graph below. Explain possible reasons for this loss, its long-term effects and how this condition can be treated. (8 marks)



**Question 41. (20 marks)**

(a) Discuss the structure of the cell membrane and describe how this structure assists the cell to exchange substances by the process of active transport. (7 marks)

(b) When comparing apes to bipedal homonins differences are seen in the skull and femur. What are these differences and how are they related to bipedalism? (6 marks)

(c) Explain how a nerve impulse would be generated and transmitted along an un-myelinated neuron. (7 marks)

**Question 42. (20 marks)**

(a) Monkeys with Parkinson’s disease-like symptoms have had their suffering eased by an injection of human embryonic stem cells (hESC) into their brain. Jun Takahashi of Kyoto University in Japan and colleagues injected these cells into monkeys whose brains had been chemically damaged to cause Parkinson’s symptoms.

Describe the neurological cause of Parkinson’s disease, state two symptoms these monkeys would have shown prior to their treatment with hESC, and suggest reasons why stem cells are believed to be a possible treatment for this condition. (7 marks)

(b) Explain how the Founder effect and migration may have contributed to the incidence of Tay Sachs disease in Eastern European Ashkenazi Jewish populations around the world.

(7 marks)

(c) Determining the age of fossils is critical if we are to understand the relationships between species and provide further evidence for the theory of evolution. Fluorine dating is one mechanism that can be employed to date fossils. Explain how this process works, what information it can provide, and what its limitations are. (6 marks)

**End of Questions**

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**Additional working space**

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Use the grid to answer Question 32 if you have cancelled your first attempt.

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**Acknowledgements**

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**Question 20**; from Addison Wesley Biology Tests by Pamela Ramsey (Addison-Wesley Publishing Company, Inc, 1984).

**Questions 23 & 24 and Question 40**; from General Certificate of Secondary Education, Higher Tier Specimen Paper, Human Health & Physiology 44151H. (http://store.aqa.org.uk/qual/newgcse/pdf/AQA-44151H-W-SQP.PDF)

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**Question 38 (c)**; from Biology 2 by Mary Jones and Jennifer Gregory, (Cambridge University Press, 2001).