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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**  **Semester 1 Examination, 2015**  **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] | 12 | 12 | 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 2015.* 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 letter 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.

MULTIPLE CHOICE QUESTIONS

1. Vaccination using dead pathogens is an example of:

1. Natural passive immunity.
2. Artificial passive immunity.
3. Natural active immunity.
4. Artificial active immunity.

Look at the three skulls below. Use these drawing to answer question 2.

|  |  |  |
| --- | --- | --- |
| A | B | C |
| http://3.bp.blogspot.com/_vZtAOUAS7HQ/SDD6C3TtgHI/AAAAAAAAAIc/b-16E1IpaCk/s400/skull_study_profile-400.png | http://www.transientvisions.com/images/gorilla_skull.jpg | http://4.bp.blogspot.com/_prb792zvLfg/S7qyhS7Gt0I/AAAAAAAAAtg/QUdz7-X3dlU/s1600/Australopithecus.jpg |

2. Which skull/s will have the foramen magnum further forward and directly under the skull??

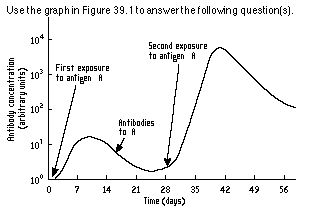
(a) A

(b) B

(c) C

(d) A and C

Use the diagram below to answer questions 3 and 4.



1. Why does the antibody concentration between 21 and 28 days **not** drop back to zero?
2. Memory T cells carry antibodies able to respond to antigen A.
3. Killer T cells carry antibodies able to respond to antigen A.
4. Memory B cells carry antibodies able to respond to antigen A.
5. Plasma B cells carry antibodies able to respond to antigen A.
6. The response to antigen A at 28 days would result in:
7. A rapid response and little or no symptoms of infection.
8. A reduction in T cells, but an increase in B cells.
9. Similar symptoms as seen in days 0 to 14.
10. A new set of antigens being produced.

5. Solutions having a lower concentration of solutes than the surrounding

environment are \_\_\_\_\_\_\_ to the environment.

(a) isotonic

(b) hypotonic

(c) hypertonic

(d) polar

6. Which of the following can diffuse directly through the phospholipid bilayer of the plasma membrane?

(a) Bacteria.

(b) Water.

(c) Large protein molecules.

(d) Lipids such as organic oils.

7. The following shows a number of cultural developments that occurred over time. Which of the following lists shows the **incorrect** order in which these advances occurred?

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

(b) use of fire, art, growing crops

(c) stone tools, art

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

8. 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.

9. In 1550 AD 60% of the population of the village of La Pont in France were killed by an outbreak of Plague. This altered the allele frequency of the village. This is an example of:

(a) Random genetic drift.

(b) Founder effect.

(c) Genetic bottleneck.

(d) Sociocultural isolation.

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

i) burial of the dead

ii) use of oldowan tools

iii) grew crops

iv) use of bone and antler for tools

v) used fire

vi) 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

11. Which of the following statements is true?

(a) Bipedalism is a result of chance mutation

(b) Cranial capacity has decreased during human evolution

(c) The opposability of the thumb allowed for improved toolmaking

(d) Fire was first used by Australopithecus for cooking

12. 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.

13. Which of the following is **not** an advantage of the use of fire?

(a) Clearing land.

(b) Flushing out prey, when hunting.

(c) Kills parasites in meat.

(d) Decreases the time available for social interaction.

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

(a) Can be used to diagnose the presence of pathogens, such as the AIDS virus.

(b) Allows us to clone copies of ourselves.

(c) Allows us to produce many copies of one strand of DNA.

(d) Allows damaged genes to be cut out a strand of DNA.

15. An investigation was done into the Body Mass Index (BMI) of 1000 different 25 year old men from a town in Queensland. Of all the men the BMI ranged between 19 and 26. One man had a BMI of 32. His results were removed from the data as his results were seen as an:

(a) outlier

(b) error

(c) inference

(d) extrapolation

16. Translation during protein synthesis can be described as:

(a) The copying of the template for making a protein form DNA to RNA in the cytoplasm of the cell.

(b) The movement of tRNA from the nucleus to the cytoplasm.

(c) The joining of Amino acids into specific sequences at the ribosome to produce peptide chains. A template held on mRNA allows the correct sequencing of the amino acids.

(d) The movement of mRNA from the nucleus to the cytoplasm.

17. For a specific gene:

(a) The promoter region of is the point where the RNA polymerase binds on.

(b) The first exon and last intron of a gene tell the RNA where to bind.

(c) The promoter region of DNA is located just before the inhibiter region.

(d) The promoter region of DNA is located just after the point where the RNA polymerase disconnects after transcription.

18. Which of the following **DOES NOT** show a nitrogen base sequence for a strand of DNA?

(a) AATTCTAGGTAG

(b) TTCCGTAGCTGA

(c) TTCGUCTCGATC

(d) ACGTTACGCGCG

19. The diagram below shows the limbs of different vertebrates. These limbs are described as homologous organs.



The differences between these limbs shows that:

(a) changes due to genetic drift have occurred over a long period of time.

(b) variations in structure has evolved from a common ancestor.

(c) structures have evolved from different ancestors existing in similar environments.

(d) structures have been acquired to suit different environments.

20. During protein synthesis, for transcription to take place, a particular enzyme must bind to a specific sequence of DNA that regulates gene expression and is on the same DNA strand as the gene that is to be transcribed.

The enzyme and the specific sequence of DNA are called, respectively,

(a) RNA polymerase and a promoter gene.

(b) RNA polymerase and a regulator gene.

(c) DNA polymerase and a promoter gene.

(d) DNA polymerase and a regulator gene.

21. *Staphylococcus aureus* is a bacterium that is a common cause of skin infections. It was previously killed by the antibiotic methicillin. However, a strain of *Staphylococcus aureus* is now resistant to this antibiotic. Which of the following statements **best** explains how methicillin-resistant *Staphylococcus aureus* originated?

(a) Methicillin directly caused mutations in the bacterial DNA, resulting in some

bacteria that were resistant to the drug.

(b) Changes in the bacterial DNA sequence by chance produced a strain resistant to methicillin.

(c) Bacteria with resistance to methicillin survived due to natural selection.

(d) Genetic drift caused more bacteria with resistance to survive, creating a

methicillin-resistant population.

22. Which of the following conditions could gene therapy be used to treat?

(a) The common cold.

(b) Bacterial skin infections.

(c) Bruising.

(d) Cystic fibrosis.

23. Which of the following defines length of gestation?

(a) The time between conception and birth.

(b) The size of the cerebral cortex.

(c) The amount of prognation.

(d) The time between birth and sexual maturity.

24. There is an inexpensive technique used to "amplify" - copy - small segments of DNA. This technique is needed because large amounts of a sample of DNA are necessary for molecular and genetic analyses. The common method is called:

(a) Gene probes.

(b) Phoresis.

(c) Polymerase chain reaction.

(d) DNA finger printing.

25. The location of a gene on a chromosome can be found with a gene probe. These probes have what type of markers on them?

(a) Radioactive

(b) Fluorescent.

(c) Permanent

(d) Radioactive and/or fluorescent.

26. When the RNA polymerase copies the structural gene, not all of the base sequences on the DNA are needed to make the desired protein. The unneeded sequences are called**:**

(a) Deletions.

(b) Exons.

(c) Introns

(d) Transcriptions.

27. During protein transcription the DNA strand that is copied to make the mRNA is called the:

(a) Template strand.

(b) Coding strand.

(c) tRNA.

(d) Splicing strand.

### 28. [Wisdom teeth](http://en.wikipedia.org/wiki/Wisdom_tooth) are third molars that human ancestors used to help in grinding down plant tissue. The common postulation is that the skulls of human ancestors had larger jaws with more teeth, which were possibly used to help chew down foliage to compensate for a lack of ability to efficiently digest the [cellulose](http://en.wikipedia.org/wiki/Cellulose) that makes up a plant cell wall. As human diets changed, smaller jaws were [naturally selected](http://en.wikipedia.org/wiki/Natural_Selection), yet the third molars, or "wisdom teeth," still commonly develop in human mouths. Currently, wisdom teeth have become useless and even harmful to the extent where surgical procedures are often performed to remove them. As a result of this information we could call wisdom teeth:

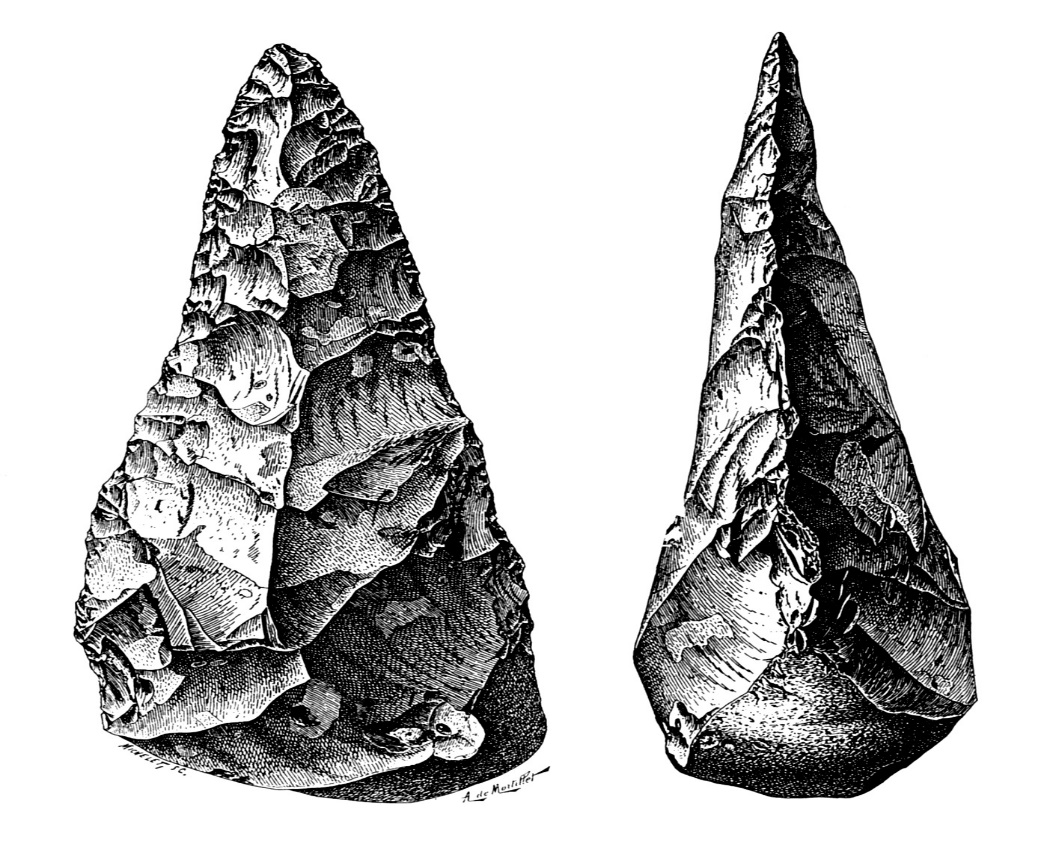
(a) Serendipitous adaptations.

(b) Vestigial organs/structures.

(c) Non-homologous anatomical structures showing shared ancestors.

(d) An advantage adaptation to modern humans.

Use the diagram below to answer questions 29 and 30.



29. The diagram shows:

(a) Oldowan tools typical of Humans between 2.5 and 1.2 million years BP.

(b) Oldowan tools typical of Humans between 1.6 million years and 200,000 years BP.

(c) Acheulean tools typical of Humans between 1.6 million to 200,000 BP.

(d) Mousterian tools typical of Humans between 2.5 and 1.2 million years BP.

30. The tool culture that arose after the tools shown in the diagram is known as:

(a) Oldowan.

(b) Acheulean.

(c) Mousterian.

(d) Bronze.

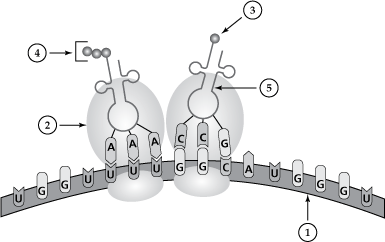
**END OF SECTION 1**

**Section Two: Short Answer**

1. **Marks**

**Question 1. (8marks)**

The diagram below shows part of the process of protein synthesis.

[](http://www.google.com.au/url?sa=i&rct=j&q=protein+translation+diagram&source=images&cd=&cad=rja&docid=sVh3265btovfUM&tbnid=6wwYFcFV1wfkSM:&ved=0CAUQjRw&url=http://mdk12.org/instruction/clg/public_release/biology/G3_E2_I1.html&ei=oM4WUrK4F47MkQXu9IBI&psig=AFQjCNEYBxjdH-S5biysDZEeFDJQK1_S9Q&ust=1377312788122406)

(a) What is this part of the process called? (1 mark)

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(b) Name the following structures: (4 marks)

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) (i) How is structure 1 similar to DNA? (1 mark)

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(ii) How is structure 1 different to DNA? (2 marks)

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**Question 2**. Use the diagram below to answer question 2. **(7 marks)**

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a) Structures C and D make up most of the membrane. What are they and how do they prevent water moving through the membrane? (3 marks)

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(4 marks)

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SECTION 2 CONTINUES ON THE NEXT PAGE

**Question 3. (12 marks)**

Mosquitoes resistant to the pesticide DDT first appeared in India in 1959. The table below shows how the mosquito resistance to DDT changed over time in India once spraying began.

|  |  |
| --- | --- |
| Time (months) | Mosquitoes resistant to DDT (%) |
| 0 | 4 |
| 8 | 45 |
| 12 | 77 |

(a) Graph this data. (5 marks)

(There is a spare graph page at the end of this booklet. If you need to use it, cross this graph out completely and write, “See spare graph grid” on the grid below).

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Use this graphed information, from part (a) to answer the rest of question 3.

(b) (i) What percentage of mosquitoes would you expect to be resistant to DDT at four months ? (1 mark)

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(ii) Using correct terms explain if this is a reliable estimate. (2 mark)

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(c) Explain why genetic variation within a population is necessary for evolution.

(2 marks)

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(d) What could have been the origin of the genetic variation in this population? (2 marks)

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**Question 4. (10 marks)**

The expenditure on the treatment of osteoarthritis by health systems has increased in the past 10 years.

(a) What is osteoarthritis and what are some of its symptoms?

(4 mark)

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(b) Give a possible reason for the increase in expenditure on the treating osteoarthritis.

(2 marks)

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(c) List some of the possible treatments that money may have been spent on when dealing with osteoarthritis.

(4 marks)

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**Question 5 (11 marks)**

Of all the primates, living or extinct, few have been bipedal.

(a) List 3 extinct bipedal primates. (3 mark)

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(b) The species ***Homo neanderthalensis*** are thought to have had a cranial capacity similar to Homo sapiens. Now might this have been determined? (3 mark)

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(c) What might the similarity in cranial capacity between Homo neanderthalensis and Homo sapiens infer?

. (2 mark)

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(d) Describe the geographical location, lifestyle and the time that Homo neanderthalensis were present on the Earth (3 marks)

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**Question 6 (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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**Question 7 (5 marks)**

What are germ line mutation and somatic mutations. State which will have an impact on evolution, giving a reason for your choice.

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**Question 8 (10 marks)**

1. Allele frequency can be changed by random genetic drift and genetic

bottle necks.

1. What is meant by allele frequency?

(1 marks)

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1. Give a brief description of random genetic drift and state what type of populations it can have the greatest impact on?

(2 marks)

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1. Give a brief description of genetic bottle necks and give one possible cause.

(3 marks)

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1. Natural selection can also alter allele frequency. Briefly describe natural selection.

(4 marks)

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**Question 9 (6 marks)**

Exocytosis and endocytosis can move materials through the plasma membrane. How are the two processes similar and how are they different. You may choose to use a diagram to answer this. Endocytosis can be further divided into two forms. What are these two forms called and how do they differ?

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**Question 10. (7 marks)**

Describe the process of RNA splicing. This should be accompanied with a suitable diagram/s.

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**Question 11. (6 marks)**

State how changes in tools and fire use affected the dentition and prognation in bipedal primates.

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**Question 12 (5 marks)**

**For the words in this table write a definition.**

|  |  |
| --- | --- |
| Word | Meaning |
| Variable |  |
| Prognation |  |
| Pentadactyl |  |
| Species |  |
| Arboreal |  |

**End of Section 2**

**Section 3: Extended Answer Questions. 40 Marks**

This section contains three (3) questions. Select and **attempt any two (2) questions** from questions 1, 2 and 3. Write your answers on the lined pages provided. Answers should be written in a blue or black pen.

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

Suggested working time for this section is 50 minutes.

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**Question 1 (20 marks)**

(a) Name the process used to amplify a segment of DNA and then describe the steps in the process.

(8 marks**)**

(b)Primates are grouped together in one Order. What are characteristics shared by all primates. Describe evolutionary trends moving from simple to more complex primates.

(12 marks)

**Question 2 (20 marks)**

(a) The Humoral or Antibody response is an important form of specific immunity.

I. What is meant by specific immunity?

(1 marks)

II. Outline the stages in the antibody response from initial macrophage contact with an antigen.

(7 marks)

III. Describe two of the possible interactions between antibodies and antigens that can occur to deal with antigens. You may use suitable diagrams if you wish.

(6 marks)

IV. This response is known as natural active immunity. How does the use of attenuated antigens differ from this?

(4 marks)

(b) How has the use of attenuated antigens in recent years altered the proportion of the population dying from infectious disease?

(2 marks)

**Question 3 (20 Marks)**

The Great apes, for example gorillas, are not bipedal; they knuckle walk. With regard to adaptations to bipedalism, compare the skeleton of a great ape to that of a human. State how the features of the human skeleton aid bipedal locomotion.

(20 marks)

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**Spare graph grid**

