# 2011 Trial HSC Paper

**Disclaimer**: This paper is written as a trial HSC paper. It is designed to provide practice consistent with the demands of the HSC course and its examination. However, we do not guarantee it predicts question content for the actual HSC examination.

**2011**
HSC TRIAL
EXAMINATION PAPER

# Biology

**General Instructions**

- Reading Time – 5 minutes
- Working Time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Student Number at the bottom of this page

**Total Marks - 100**

**Section I** Pages 2–16

**75 marks**

This section has two parts, Part A and Part B

Part A – 20 marks

- Attempt Questions 1–20
- Allow about 35 minutes for this part

Part B – 55 marks

- Attempt Questions 21–29
- Allow about 1 hour and 40 minutes for this part

**Section II** Pages 17–23

**25 marks**

- Attempt ONE question from Questions 30–34
- Allow about 45 minutes for this section



**Student Number:** _____

## Section I
**75 marks**

**Part A – 20 marks**
**Attempt Questions 1–20**
**Allow about 35 minutes for this part**

Use the multiple-choice answer sheet for Questions 1-20

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**1** Which is the best definition of enantiostasis?

(A) The maintenance of a constant internal environment.

(B) The maintenance of a constant external environment.

(C) The detection of changes in the environment.

(D) The maintenance of a constant internal environment despite fluctuating changes in salt concentration

**2** Which of the following is a non-transmissible disease?

(A) Food poisoning

(B) Chicken pox

(C) Colon cancer

(D) Polio myelitis

**3** Below is a sketch of a microorganism.

x900 mag

What is the microorganism?

(A) A protozoan

(B) A prion

(C) A macroparasite

(D) A bacterium

**4** When DNA is extracted from cells of E. coli, and analysed for base composition, it is found that 12% of the bases are thymine.

What percentage of the bases are guanine?

(A) 38%

(B) 24%

(C) 76%

(D) 12%

**5** A DNA strand has the following bases:


What are the bases on the complementary strand?

(A) 3´ - GAATTC - 5´

(B) 3´ - GAAUUC - 5´

(C) 3´ - CTTAAG - 5´

(D) 5´ - CTTAAG - 3´

**6** What is epidemiology?

(A) The study of human epidermal layers

(B) The attempt to prevent the entry of harmful diseases into Australia

(C) The analysis of disease patterns in society

(D) The isolation of organisms to prevent the spread of disease

**7** What is meiosis?

(A) A sexual process that combines cells for the purpose of growth

(B) An asexual process whereby cells divide for the purpose of growth and repair

(C) A process in which cell division produces gametes for sexual reproduction

(D) The process to carry the genetic code from the DNA

**8** Which of the following is NOT true of alleles?

(A) Alleles are alternative forms of the same gene.

(B) Alleles are found on corresponding loci of homologous chromosomes.

(C) Alleles are sections of RNA called genes.

(D) Alleles can be dominant or recessive.

**9** In a famous experiment, Pasteur used swan necked flasks to disprove a theory.

Swan necked flasks

What was the theory called?

(A) Spontaneous generation

(B) Natural Selection

(C) Evolution

(D) Cell theory

**10** In the snapdragon flower, red or white flowers are controlled by a single pair of alleles. If a plant was to receive an allele for red flowers and an allele for white flowers it would produce a plant with a pink flower.

What is this an example of?

(A) Sex linkage

(B) Codominance

(C) A hybrid

(D) Incomplete dominance

**11** Which adaptations would be found in plants living in an estuary?

(A) Leaves that are able to accumulate salt

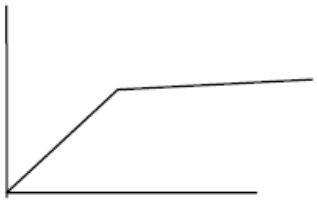
(B) Leaves with a large surface area

(C) Thicker waxy cuticle

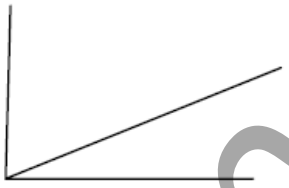
(D) Curled leaves

**12** Which of the following graphs best shows the effect of increasing temperature on enzyme activity?

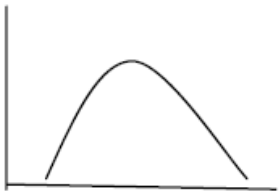
(A)



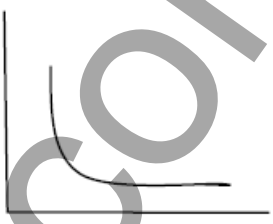
(B)



(C)



(D)



**13** The glomerula filtrate may contain

(A) urine.

(B) red blood cells and large proteins.

(C) urea, glucose, water and salts.

(D) red blood cells, glucose and large proteins.

**14** What causes Malaria?

(A) Bacteria

(B) Prions

(C) Protozoa

(D) Virus

**15** How would blood leaving the intestinal area be different to the blood entering it?

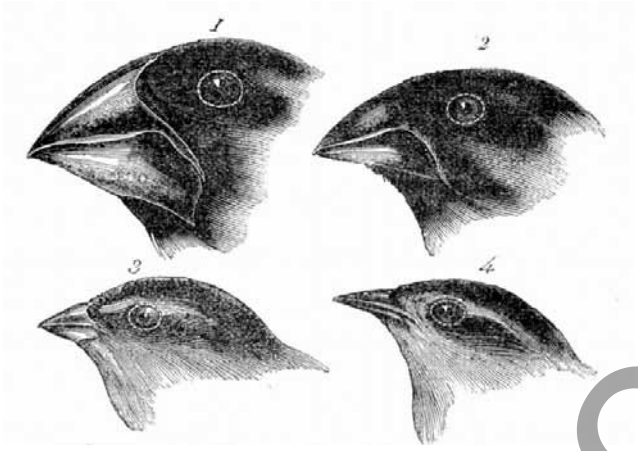
(A) Lower in carbon dioxide, lower in oxygen and lower in glucose

(B) Higher in carbon dioxide, higher in oxygen and lower in glucose

(C) Higher in carbon dioxide, higher in oxygen and higher in glucose

(D) Higher in carbon dioxide, lower in oxygen and higher in glucose

**16** What is the evolution of Darwin's finches an example of?



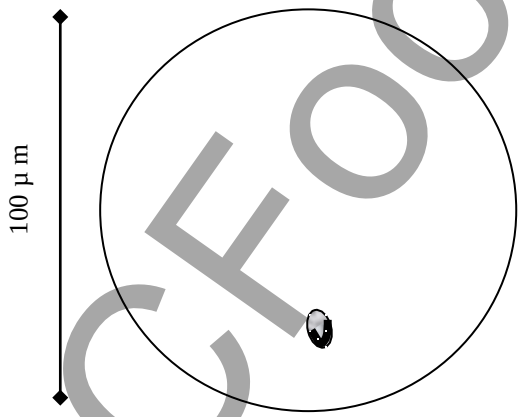

(A) Geographic isolation which has led to convergent evolution

(B) Human interference

(C) Evidence for divergent evolution

(D) Evidence for convergent evolution

**17** A sample of water was taken from a treatment plant. It was found to contain giardia.




Assuming the field of view was under high power, what is the size of the specimen closest to?

(A) 20 µm

(B) 8 µm

(C) 8 mm

(D) 4050 µm

**18** Of the following scientists, who made the greatest contribution to a better understanding of the immune response and the effectiveness of immunisation programs?

(A) Watson, Crick, Franklin and Wilkins

(B) McFarlane

(C) Ross

(D) Sutton and Boveri

**19** Which of the following is NOT a characteristic of capillary blood vessels?

(A) Repeatedly branched

(B) Small diameter

(C) Permeable to salts (ions)

(D) Thick walled

**20** From what blood groups could a person with blood group $A^-$ receive a transfusion from?

(A) groups $O^+$ and $O^-$

(B) group $A^+$

(C) groups $A^+$, $O^+$ and $O^-$

(D) groups $A^-$ and $O^-$

**2011 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION**

# Biology

## Section I (continued)

**Part B – 55 marks**
**Attempt Questions 21–32**
**Allow about 1hour 40 minutes for this part**

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

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**Question 21** (7 marks)

(a) Construct a labelled diagram of the functional unit of the kidney. **3**

(b) (i) Alcohol inhibits the brain from making the hormone antidiuretic hormone (ADH). **3**

Explain why drinking alcohol will cause a person to urinate more.

(ii) On your diagram, shade the region where ADH acts. **1**

**Question 22** (6 marks)

The genetic disease Phenylketonuria (PKU) is caused by a recessive allele. It is characterized by an inability to produce an enzyme that breaks down phenylalanine.

An infant is being tested for PKU.

The family provides the following information:

- normal parents
- maternal grandfather has PKU
- infant's male sibling has PKU
- mother's twin brother is normal

(a) Using the information provided, construct a pedigree. **3**

(b) Predict the likelihood that the infant has PKU. Give reasons for your answer. **3**

**Question 23** (4 marks)

Discuss the ethical issues arising from the development and use of transgenic species. **4**

**Question 24** (10 marks)

(a) Complete a labelled diagram explaining key events in transcription and translation. **5**

(b) Genetic variation is essential for the survival of a species. **3**

Discuss the processes which produce variation within the offspring of a species.

(c) Using an example, outline how environmental factors affect the expression of gene in an individual. **2**

**Question 25** (4 marks)

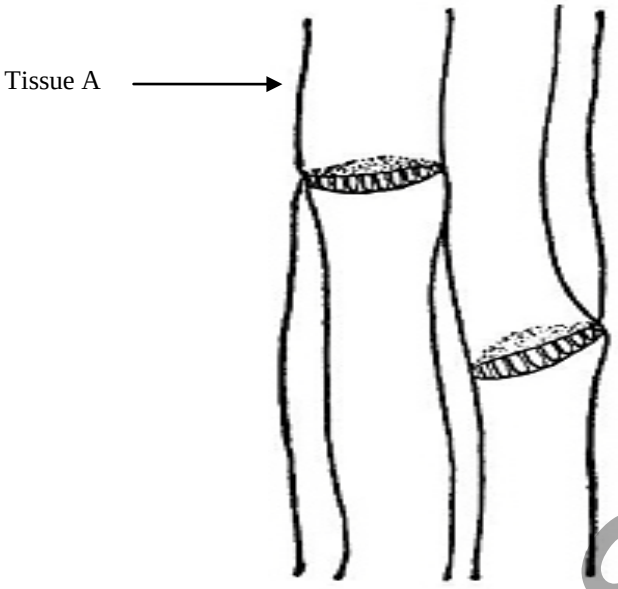
An E. coli outbreak has occurred in Northern Germany. It has been responsible for numerous deaths. The E. coli source appears to be a contaminated food source.

(a) Outline how you would go about identifying E. coli as the agent of disease. **3**

(b) Describe a safety feature you would need to consider when dealing with pathogenic microorganisms. **1**

**Question 26** (4 marks)

Observe the following longitudinal section of a plant stem.

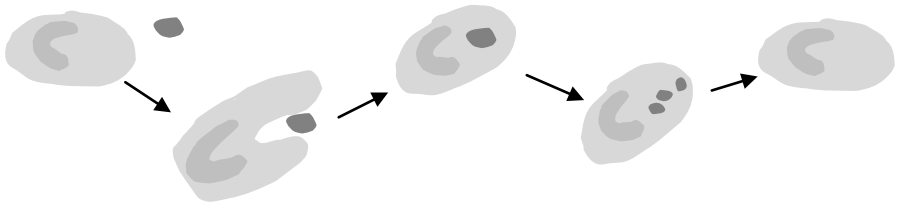



(a) Identify Tissue A and what it transports. **1**

(b) Discuss a current theory about a process that is responsible for the movement of substances in tissue A. **3**

**Question 27** (8 marks)

The diagram below is an immunological response to a bacterium.



(a) Identify this process. **1**

(b) Explain how the inflammatory response can prevent pathogen infection. **3**

(c) Describe ONE named infectious disease in terms of its: **4**

- cause
- transmission
- host response major symptoms
- treatment
- prevention
- control

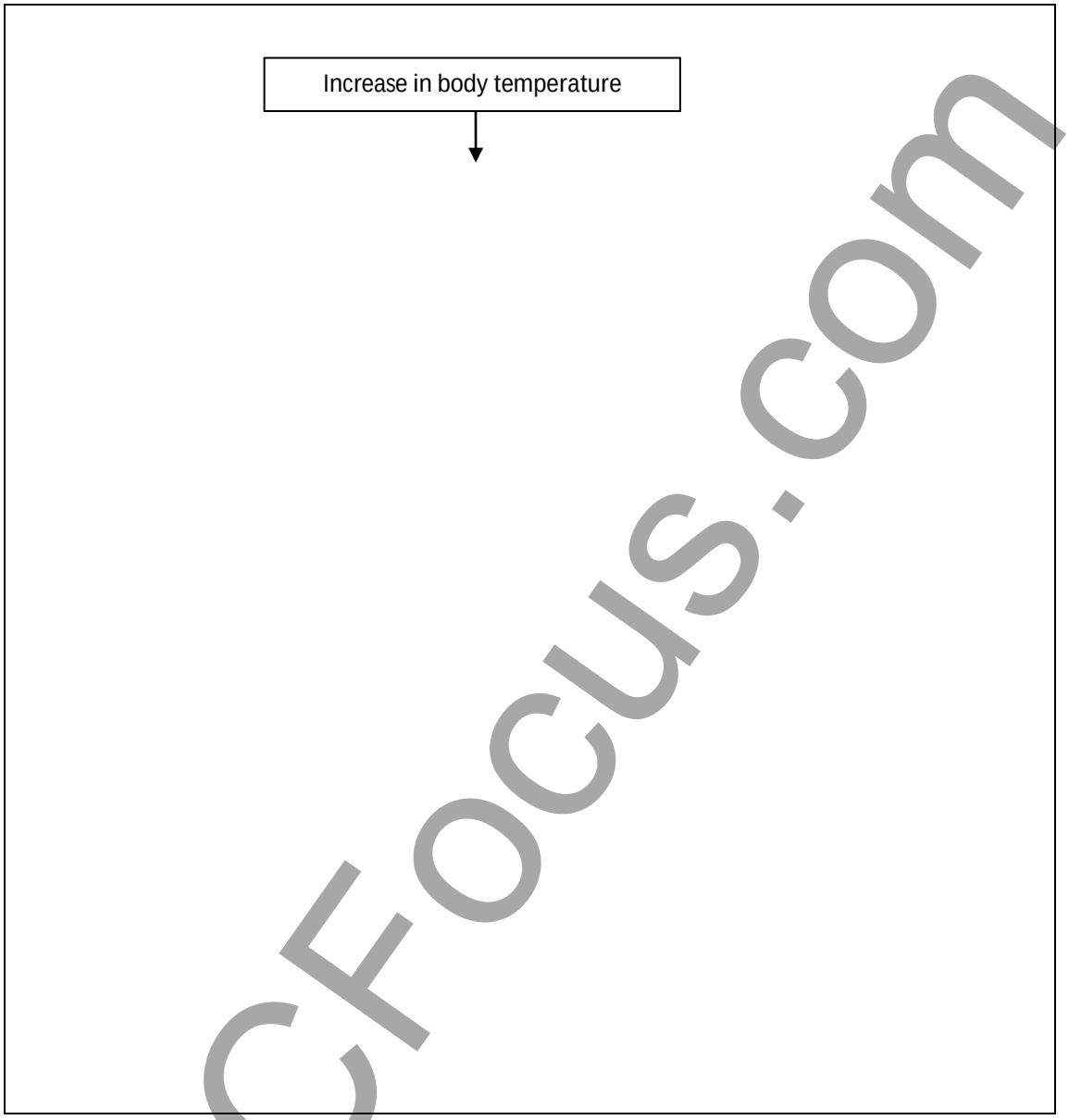
**Question 28** (7 marks)

(a) Analyse the cause and effect relationship of smoking and lung cancer. **4**

(b) Discuss how you would go about assessing the reliability and validity of secondary sources when collecting information for a report. **3**

**Question 29** (5 marks)

(a) Complete the stimulus-response pathway for an increase in body temperature in humans. **3**




(b) Explain how negative feedback operates to regulate body temperature in humans. **2**

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**End of Section I**

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# Biology

## Section II

**25 marks**
**Attempt ONE question from Questions 30–34**
**Allow about 45 minutes for this section**

Answer the parts of the question in a writing booklet. Clearly label each part of the question.

Show all relevant working in questions involving calculations.

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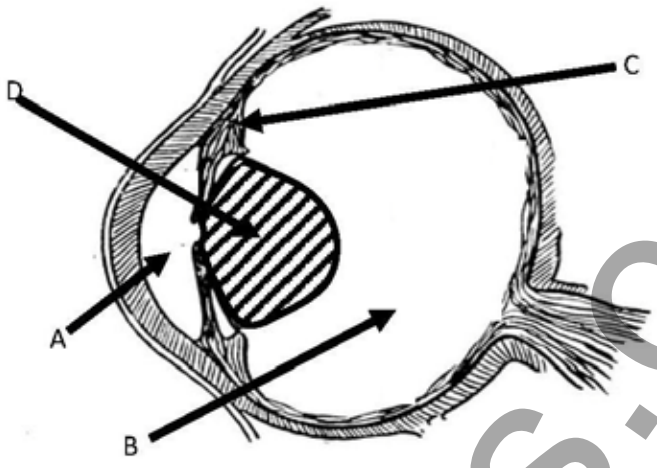
**Question 30 — Communication** (25 marks)

(a) Below is a diagram of the human eye.

Construct a table for each of the structures A, B, C and D. Relate its structure to the function. **6**




(b) (i) Draw a sketch of a graph to represent a typical action potential. **1**

(ii) Not all stimuli generate an action potential. Explain this statement. **2**

(c) (i) Outline the role of the sound shadow cast by the head in the location of sound. **2**

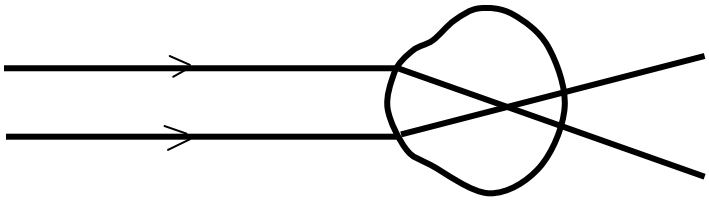
(ii) A patient presents at the doctors with a perforated eardrum. This is where the tympanic membrane becomes ruptured or punctured.

Analyse the impact that this would have on the patient's ability to hear. **4**

**Question 30 continues on page 19**

Question 30 (continued)

(d) Below is a diagram of light rays entering an eye.



(i) Identify the eye condition. **1**

(ii) Explain how this condition can be corrected. **3**

(e) Compare the range of frequencies detected by humans as sound with the range detected by TWO other mammals. Analyse the possible reasons for the differences identified. **6**

**Question 31 — Biotechnology** (25 marks)

(a) As part of your course, you performed a first-hand investigation to demonstrate the use of fermentation processes in bread or alcohol production.

(i) Outline how you would go about performing this experiment. **3**

(ii) Identify a safety feature that had to be followed. **1**

(b) (i) Identify the name of ONE organism involved in transgenic technology. **1**

(ii) Describe the gene transfer technique involved. **2**

(c) Explain how complementary DNA is produced. **4**

(d) As part of your course, you were required to complete a case study in biotechnology. **6**

Analyse the application for a medical biotechnology.

(e) Evaluate ethical issues related to ONE of the following: **8**

- development of genetically modified organisms (GMOs)
- animal cloning
- gene cloning

**Question 32 — Genetics: The Code Broken** (25 marks)

(a) In pea plants, the round seed allele is dominant over the wrinkled seed allele, and the yellow seed allele is dominant over the green seed allele. The genes for seed texture and those for seed colour are on different chromosomes. A plant heterozygous for seed texture and seed colour is crossed with a plant that is wrinkled and heterozygous for seed colour.

Determine the phenotype and genotype for this cross. Show all working. **4**

(b) Gene therapy can be used to manage genetic diseases, some forms of cancer or AIDS.

(i) Define gene therapy. **1**

(ii) Discuss how this therapy is used for a named disease. **3**

(c) As part of your studies, you performed a first-hand investigation to construct a model of DNA.

(i) Outline how you performed this experiment. **2**

(ii) Draw a scientific diagram of DNA. **1**

(iii) Evaluate the use of models to represent scientific concepts. **3**

(d) Agricultural animals have a long history of selective breeding. **4**

Using a named species, trace its history and describe the series of changes that have occurred as a result of selective breeding.

(e) Assess the evidence that analysis of genes provides for evolutionary relationships. **7**

**Question 33 — The Human Story** (25 marks)

(a) Construct a table to describe the main characteristics of each of the primate groups: **4**

- Apes
- Humans
- New and Old World monkeys
- Prosiminians

(b) As a result of technological advances, scientific opinion about the classification of primates continues to change as new information comes to light.

(i) With respect to the above statement, identify a technological advance. **1**

(ii) Analyse how this identified technological advance has changed opinions on how primates are classified. **4**

(c) Below is photograph of a fossilised early human.

(i) Outline the conditions necessary for this fossil to have formed. **2**

(ii) Discuss how a scientist might date this fossil. **3**

(iii) Outline the problems associated with relying only on the fossil record to interpret the past. **3**

(d) Evaluate the evidence for TWO different models of human evolution. **8**

**Question 34 — Biochemistry** (25 marks)

(a)

GREEN FUEL

Current research and development into an algae fuel looks promising as an alternative to fossil fuels ...

Evaluate the potential use of photosynthesis in replacing a non-renewable resource. **8**

(b) Blackman and Mathgel hypothesised that photosynthesis was a two-step process.

(i) Describe the experiment that was performed to test this hypothesis. **2**

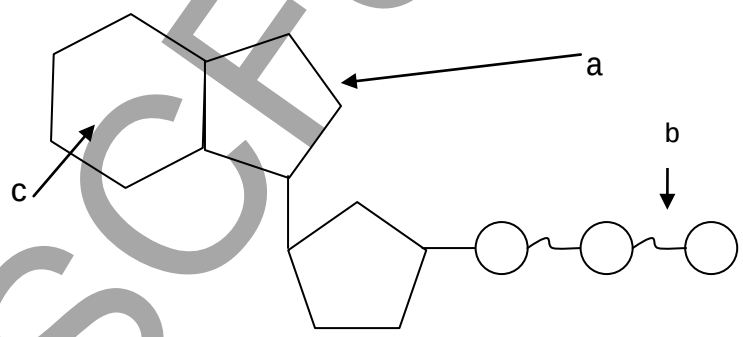
(ii) Identify TWO observations made by Blackman and Mathgel. **1**

(iii) Explain their conclusion. **2**

(c) (i) Draw and label the structure of a chloroplast. **2**

(ii) Compare the size, shape and distribution of chloroplasts in a named alga, terrestrial angiosperm and aquatic angiosperm. **4**

(d)




(i) Label the above diagram of ATP. **1**

(ii) Identify the role of ATP. **1**

(iii) Discuss the nature and organisation of the phosphodiester bonds between the phosphate groups. **4**

**End of paper**

Student Number/Name……

# 2011 BIOLOGY TRIAL HSC EXAMINATION
## Section I – Part A Answer Sheet

**20 marks**
**Attempt Questions 1–20**
**Allow about 35 minutes for this section**

Select the alternative A, B, C, or D that best answers the question. Fill in the response circle completely.

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| | | | | |
|---|---|---|---|---|
| **1** | • A | • B | • C | • D |
| **2** | • A | • B | • C | • D |
| **3** | • A | • B | • C | • D |
| **4** | • A | • B | • C | • D |
| **5** | • A | • B | • C | • D |
| **6** | • A | • B | • C | • D |
| **7** | • A | • B | • C | • D |
| **8** | • A | • B | • C | • D |
| **9** | • A | • B | • C | • D |
| **10** | • A | • B | • C | • D |
| **11** | • A | • B | • C | • D |
| **12** | • A | • B | • C | • D |
| **13** | • A | • B | • C | • D |
| **14** | • A | • B | • C | • D |
| **15** | • A | • B | • C | • D |
| **16** | • A | • B | • C | • D |
| **17** | • A | • B | • C | • D |
| **18** | • A | • B | • C | • D |
| **19** | • A | • B | • C | • D |
| **20** | • A | • B | • C | • D |

Biology HSC Trial Marking Guidelines

## Section I — Part A

**MULTIPLE CHOICE ANSWERS**

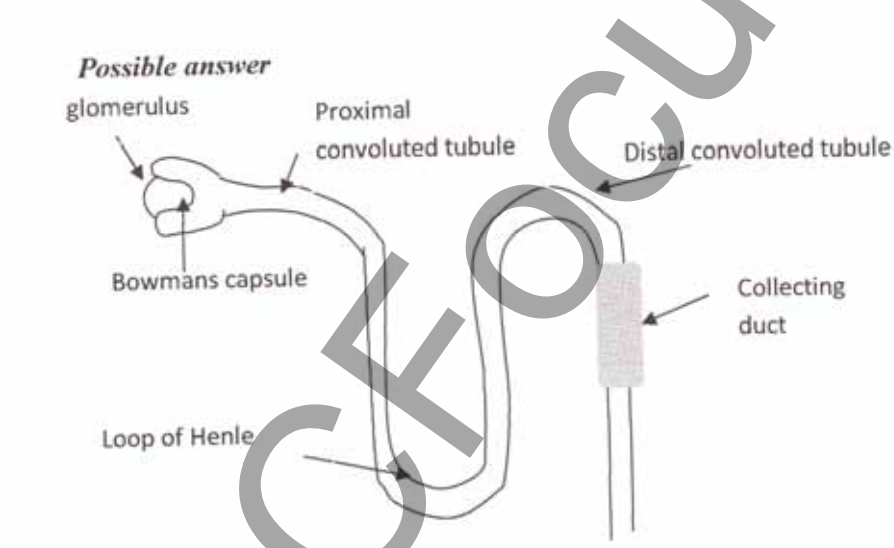
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | D | **6** | C | **11** | A | **16** | D |
| **2** | C | **7** | C | **12** | C | **17** | B |
| **3** | D | **8** | C | **13** | C | **18** | B |
| **4** | A | **9** | A | **14** | C | **19** | D |
| **5** | B | **10** | B | **15** | D | **20** | D |

## Section I — Part B

**Question 21 (7 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Correctly draws detailed and labelled nephron | 3 |
| · Provides a recognisable nephron with some correct labels | 2 |
| · Attempts to draw nephron and include labels | 1 |




**b (i)**

| Criteria | Marks |
|---|---|
| · Clearly provides function of ADH<br>· Links inhibition of ADH to increase in urine | 3 |
| · Provides some function of ADH and /or links inhibition of ADH to increase in urine | 2 |
| · Limited description of ADH | 1 |

***Possible answer***

ADH regulates water reabsorption by making the distal convoluted tubule and the collecting duct more permeable to water. In the absence of ADH, the nephron becomes less permeable to water, and more water travels through the ureter to the bladder thereby causing more frequent urination. As alcohol inhibits the production of ADH these tubules do not reabsorb more water thereby causing more frequent urination.

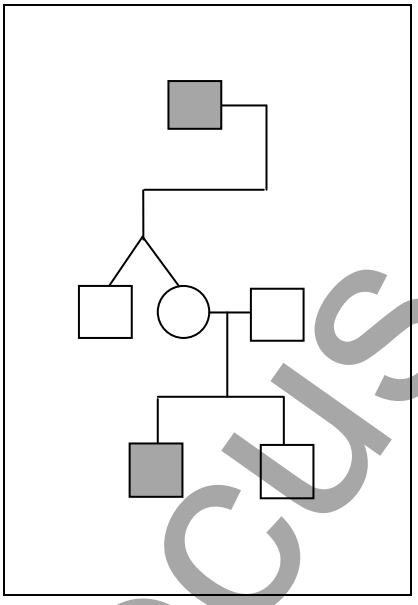
**(ii)**

| Criteria | Marks |
|---|---|
| · See shaded area on diagram above | 1 |

**Question 22 (6 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Correctly identifies sufferers, relationships and shapes | 3 |
| · Correctly identifies most sufferers, relationships, and shapes | 2 |
| · Attempts to constructs a pedigree | 1 |



**b**

| Criteria | Marks |
|---|---|
| · Correct working, clear and detailed explanation | 3 |
| · Correct working, some explanation given | 2 |
| · Correct working OR limited explanation given | 1 |

***Possible answer***

Father = recessive allele as first born child has disease, therefore, genotype= Nn.
Mother = recessive allele for PKU as first born child has disorder and father is homozygous recessive, therefore, genotype =Nn.
The possibilities of child's phenotype & genotype are:
Let N = normal n =disease PHENOTYPE: 75% chance child will be normal
25% chance child having PKU

| | N | N |
|---|---|---|
| N | NN | Nn |
| n | Nn | Nn |

GENOTYPE: 25% homozygous dominant (NN)
50% heterozygous (Nn)
25% homozygous recessive (nn)

Consequently, this child has a 25% chance of having PKU.

**Question 23 (4 marks)**

| Criteria | Marks |
|---|---|
| · Provides a detailed discussion of issues<br>· Demonstrates a thorough knowledge | 4 |
| · Provides some discussion of issues<br>· Demonstrates a sound knowledge | 3 |
| · Provides limited explanation of issue/s<br>· Demonstrates some knowledge | 2 |
| · Brief outline given of uses/development of transgenic species or issue<br>· Demonstrates limited knowledge | 1 |

***Possible answer***

Transgenic organisms include plants and animals. DNA from another species is incorporated into the DNA of the animal or plant. This is completed by engineering techniques. E.g. salmon = bGH (bovine growth hormone), is incorporated into the genes of salmon. It produces larger, faster growing fish, however, there is concern that they will upset or destroy natural ecosystems.

**Question 24 (10 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Provides detailed steps<br>· Provides correct terms<br>· Provides correct sequence | 5 |
| · Provides steps<br>· Provides most terms<br>· Provides correct sequence | 4 |
| · Provides most steps<br>· Provides some terms and / or are in correct sequence | 3 |
| · Provides some steps<br>· Provides limited terms and / or are in correct sequence | 2 |
| · Provides limited steps and terms and / or few are in correct sequence | 1 |

***Possible answer***

Transcription: DNA molecule unwinds & unzips allowing mRNA to form [A-U, G-C]/ This single stranded molecule exits nucleus & attaches to a ribosome.

Translation: The ribosome scans the mRNA in triplets (codon). Upon 'reading' a primer at 5' end, tRNA attaches corresponding amino acid at ribosome. tRNA drops away. This continues until the sequence is completed at the stop codon. Once translation has occurred the polypeptide chain is folded into its final structure.

**b**

| Criteria | Marks |
|---|---|
| · Provides clear and concise discussion using at least THREE reasons for genetic variation | 3 |
| · Provides some discussion using at least TWO reasons for genetic variation | 2 |
| · Provides an outline using at least ONE reason for genetic variation | 1 |

***Possible answer***

- Random fertilisation of gametes
- Random segregation and independant assortment – alignment of chromosomes ont he metaphase plate & the separation of chromosomes to the poles
- Crossing over – swapping of genetic material between homologous chromosomes
- Mutations – changes in the DNA

**c**

| Criteria | Marks |
|---|---|
| · Provides clear example/s of effects of environment on phenotype | 2 |
| · Provides example and/or basic description | 1 |

***Possible answer***

Genes & environemnt = phenotype
Hydrangea à low pH = blue flowers
à adding aluminium to soil = increases pH = pink or white flowers

**Question 25 (4 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Provides a clear and sequential outline | 3 |
| · Provides a mostly clear and sequential description | 2 |
| · Provides some clear steps and/or sequence | 1 |

***Possible answer***

According to Koch's postulates you would:
1. E.coli must be present in all patients with the disease
2. E.coli must be isolated and grown in pure culture.
3. Inoculated into a healthy organism (this is not ethical) / other lab techniques would be used
4. Must be reisolated. To identify the E.coli as agent of disease it must be identical to the original agent

**b** Dispose of contaminated plates appropriately (1 mark)

**Question 26 (4 marks)**

**a** Phloem transports products of photosynthesis (1 mark)

**b**

| Criteria | Marks |
|---|---|
| · Identifies theory and provides a detailed discussion of process | 3 |
| · States name and describes theory in detail | 2 |
| · States name and partially describes theory | 1 |

***Possible answer***

Source to Sink
Sugar is loaded actively into the phloem at source (leaf). Water follows as high concentration of sugar in phloem. Water pressure increases.
Sugar leaves phloem at sink (e.g. roots). Water follows causing drop in water pressure.
Pressure differences cause water and sugar to flow from source to sink.

**Question 27 (8 marks)**

**a** Phagocytosis (1 mark)

**b**

| Criteria | Marks |
|---|---|
| · Provides a detailed explanation of responses | 3 |
| · Provides some detail of response in explanation | 2 |
| · Provides a general outline | 1 |

***Possible answer***

In response to antigen mast cells release histamine causing vessels to dilate and leak. Makes tissue appear inflammed, red and hot. Activated chemicals attract macrophages. Phagocytois occurs.

**c**

| Criteria | Marks |
|---|---|
| · Detailed description of all aspects of disease<br>· Demonstrates a thorough knowledge | 4 |
| · Provides description of all/most aspects of disease<br>· Demonstrates sound knowldege | 3 |
| · Provides some aspects of the disease mentioned<br>· Demonstrates some knowledge | 2 |
| · Provides name of disease and limited detial about some of the aspects<br>· Demonstrates limited knowledge | 1 |

***Possible answer***

CAUSE: Malaria = plasmodium (parasitic protozoan )
TRANSMISSION: Anopheles mosquito is the vector and infects an individual with sporozoites where they travel to the liver, multiply and enter RBC which eventually burst and release gametes which can be taken up by a mosquito.
HOST RESPONSE: Antibodies produced against plasmodium
SYMPTOMS: Chills, fever, sweating,headache
TREATMENT: Chloroquinine
PREVENTION: Aeroguard style products, mosquito nets,
CONTROL: draining swamps, insecticides

**Question 28 (7 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Provides a highly detailed analysis linking smoking to lung cancer<br>Demonstrates a thorough knowledge | 4 |
| · Provides some analysis linking smoking to lung cancer<br>· Demonstrates a sound knowledge | 3 |
| · Provides limited discussion of link and some attempt to describe cause and effect<br>· Demonstrates some knowledge | 2 |
| · Provides a brief outline or limited attempt to describe link<br>· Demonstrates limited knowledge | 1 |

***Possible answer***
Smoking and lung cancer has been consistently linked by research. Approx. 80% of lung cancers are attributed to smoking, according to ABS.
Manufacturers of tobacco products do not acknowledge that smoking causes lung cancer.

**b**

| Criteria | Marks |
|---|---|
| · Provides a detailed discussion.<br>· Assesses relaibility and vailidity well | 3 |
| · Provides some discussion.<br>· Attempts to assess relaibility & validity | 2 |
| · Provides limited discussion and/or limited attempt to describe reliability to assess relaibility and validity | 1 |

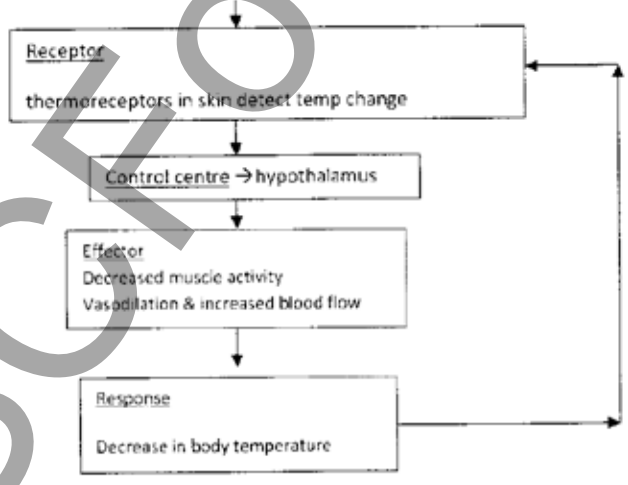
***Possible answer***
Secondary source data must be assessed for reliabilty and accuracy. All information must be supported by additional resources for relaibility. Selection of information type is also signifcant e.g. ".com" compared to ".edu" . Bias may exist so information must be supported by other sites. Document age must be considered as information can become outdated thereby inaccurate.

**Question 29 (4 marks)**

**a**

| Criteria | Marks |
|---|---|
| · Provides a detailed stimulus-response pathway | 3 |
| · Provides a stimulus-response pathway in some detail | 2 |
| · Provides a limited outline and/or sequence | 1 |

***Possible answer***




**b**

| Criteria | Marks |
|---|---|
| · Provides a clear and concise explanation | 2 |
| · May provide an outline and/or limited explanation | 1 |

***Possible answer***
Negative feedback is a process that counteracts changes in the body so that homeostasis can be maintained. For example, if body temperature increases the body activates effectors to reduce temperature. Once the temperature has returned to normal, effectors must stop. Negative feedback is the process which controls this action.

## Section II —Electives 25 marks

## Question 30 – COMMUNICATION (25 marks)

**a**

| Criteria | Marks |
|---|---|
| · Correctly identifies parts<br>· Provides detailed relationship between structure and function<br>· Uses an effective table | 6-5 |
| · Correctly identifies parts<br>· Provides some details of relationship between structure and function<br>· Uses a table | 4-3 |
| · Identifies some parts maybe correctly identified,<br>· Provides some information about function and some structure | 2-1 |

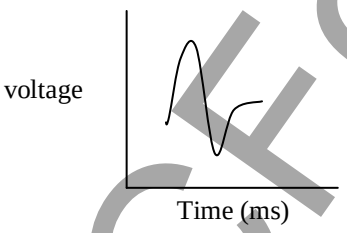
***Possible answer***

| PART | | STRUCTURE | FUNCTION |
|---|---|---|---|
| A | Aqueous humour | Watery fluid | Maintains the shape of the eye |
| B | Vitreous humour | Clear fluid between lens and retina | Maintains shape of eye<br>Holds retina in place |
| C | Ciliary body | Contains muscles | Provides support to lens<br>Alters shape of lens |
| D | Lens | A flexible transparent structure | Allows light to enter rear of eye<br>Refracts light so image can be focussed onto retina |

**b (i)**

| Criteria | Marks |
|---|---|
| · Provides correct sketch of graph | 1 |

***Possible answer***




**ii)**

| Criteria | Marks |
|---|---|
| · Provides a clear and correct explanation | 2 |
| · Provides an explanation | 1 |

***Possible answer***

Not all stimuli will generate an action potential. The threshold needs to be reached in order for the neuron to 'fire'. This threshold is necessary otherwise all stimuli would generate a firing of neurons

**c (i)**

| Criteria | Marks |
|---|---|
| · Provides a detailed outline | 2 |
| · Attempts to outline or provides a description | 1 |

***Possible answer***
Humans cannot move ears, but are able to locate the direction of a sound. This is because the sound is heard more loudly by the ear nearest to it and also slightly earlier. In some animals, the pinna is mostly skin and cartilage with some muscles allowing them to move their ears in response to sound. Sounds from the front and sides become enhanced as they are directed into the auditory canal while sounds from behind are reduced.

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides a detailed analysis<br>· Demonstrates a thorough knowledge | 4 |
| · Provides some analysis<br>· Demonstrates sound knowledge | 3 |
| · Provides some explanation may be given<br>· Demonstrates some knowledge | 2 |
| · Provides an outline<br>· Demonstrates limited knowledge | 1 |

***Possible answer***
Sound waves are collected by the pinna and travel down auditory canal to tympanic membrane as normal. However, if there is a hole in the tympanic membrane it is unable to vibrate at the same frequency as the sound wave. Thus the transmission of sound to the ossicles is effected. The poor transmission of sound is detected by hair cells in the organ of corti and pass a reduced vibration signal to the auditory nerve.

**d (i)** myopia (1 mark)

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides a detailed explanation | 3 |
| · Provides some detail | 2 |
| · Provides a description only | 1 |

***Possible answer***
Rays from distant objects are focused before the retina rather than on the retina. Myopia can be corrected with concave lenses for viewing distant objects. This lens causes parallel light rays to diverge slightly before entering the eye so that the eye lens can converge the rays onto retina.

**e**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of range of frequencies detected by humans and two mammals<br>· Provides well-supported analysis of possible reasons for the differences identified<br>· Demonstrates coherence and logical progression of ideas | 6-5 |
| · Demonstrates a sound knowledge of range of frequencies detected by humans and two mammals<br>· Provides some analysis of possible reasons for the differences identified<br>· Demonstrates ideas in a clear manner | 4-3 |
| · Demonstrates a basic knowledge of of range of frequencies detected by humans and two mammals<br>· Provides discussion of possible differences identified<br>· Comminucates ideas in a simple fashion | 2-1 |

***Answer could include***

The range of frequencies that can be detected by humans is 20-23,000 Hz.
Frequency range of sounds differs from species to species.

- Dog 67- 45000 Hz
- Whale 1000 – 123000 Hz

## Question 31 – BIOTECHNOLOGY (25 marks)

**a (i)**

| Criteria | Marks |
|---|---|
| · Provides a clear, concise and sequential outline | 3 |
| · Provides a mostly clear and sequential outline | 2 |
| · Provides some outline | 1 |

***Possible answer***
Set up fermentation equipment

**(ii)** Take care with glassware – any breakages clean up immediately (1 mark)

**b (i)** Bt Corn (1 mark)

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides detailed description | 2 |
| · Lists some key features of technique | 1 |

***Possible answer***
Enzymes splice gene from the Bt bacterium. The gene inserted into plasmid. A vector transfers gene onto corn genome.

**c**

| Criteria | Marks |
|---|---|
| · Provides a well detailed and articulate explanation<br>· Demonstrates a thorough knowledge | 4 |
| · Provides some explanation<br>· Demonstrates sound knowledge | 3 |
| · Provides limited explanation<br>· Demonstrates some knowledge | 2 |
| · Provides outline<br>· Demonstrates limited knowledge | 1 |

***Possible answer***
PCR is used to amplify segments of DNA. The sample is first heated so the DNA separates into two pieces of single-stranded DNA. A "Taq polymerase" (enzyme) synthesizes 2 new strands of DNA, from a template. A chain reaction now occurs, repeating this process.

**d**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of the application for a medical biotechnology Provides well-supported analysis of the application for a medical biotechnology<br>· Demonstrates coherence and logical progression of ideas | 6-5 |
| · Demonstrates a sound knowledge of the application for a medical biotechnology<br>· Provides sound analysis of the application for a medical biotechnology<br>· Demonstrates ideas in a clear manner | 4-3 |
| · Demonstrates a basic knowledge of the application for a medical biotechnology<br>· Provides limited discussion of the application for a medical biotechnology<br>· Comminucates ideas in a simple fashion | 2-1 |

***Possible answer***

Recombinant human insulin

The DNA for human insulin is inserted into a plasmid and reintroduced into a bacterium. The human gene is 'read' by the cell and human insulin is produced by the bacterium. In a laboratory the synthetic insulin is harvested and can then be used to treat patients with diabetes.

**e**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of ethical issues related to one of the given choices<br>· Provides well-supported evaluation of ethical issues related to one of the given choices<br>· Demonstrates coherence and logical progression of ideas | 8-7 |
| · Demonstrates a sound knowledge of ethical issues related to one of the given choices<br>· Provides sound evaluation of ethical issues related to one of the given choices<br>· Demonstrates ideas in a clear manner | 6-5 |
| · Demonstrates a basic knowledge of ethical issues related to one of the given choices<br>· Attempts some evaluation OR discusses ethical issues related to one of the given choices<br>· Comminucates ideas in a simple fashion | 4-3 |
| · Provides some relevant information | 2-1 |

***Possible answer***

Many GMOs are designed to be food for human consumption. The evaluation of the ethical issues can be decided on the arguments for and against the issues.

For:

- Improved quantity and quality of food
- Reduced amount of chemical sprays on crops
- Improved shelf life

Against

- Allergic reactions in consumer
- Reduction in biodiversity
- Limited research

## Question 32 – GENETICS: THE CODE BROKEN (25 marks)

**a**

| Criteria | Marks |
|---|---|
| · Provides all working,<br>· Correctly determines the phenotype & genotype | 4 |
| · Provides working<br>· Determines phenotype & genotype with some accuracy | 3 |
| · Provides some working<br>· Provides limited phenotypic & genotypic ratio provided | 2 |
| · Limited working<br>· Incorrect phenotypic & genotypic ratio or ratio not provided | 1 |

***Possible answer***

Let R = round r = wrinkled  Let Y = yellow y = green

RrYy x rrYy

| | RY | Ry | rY | ry |
|---|---|---|---|---|
| rY | RrYY | RrYy | rrYy | rrYy |
| Ry | RrYy | RRyy | rrYy | Rryy |
| rY | RrYY | RrYy | rrYY | rrYy |
| Ry | RrYy | Rryy | rrYy | rryy |

Genotype:

2/16 RrYY : 4/16 RrYy : 1/16 RRyy : 2/16 Rryy : 5/16 rrYy : 1/16 rryy : 1/16 rrYY

Phenotype:

4/16 round/yellow : 3/16 round/green : 4/16 wrinkled/yellow : 1/16 wrinkled/green

NB

fractions not simplified

Punnet square could show 2 rows as row 3 + 4 duplicates

**b (i)**

| Criteria | Marks |
|---|---|
| · Provides correct definition | 1 |

***Possible answer***

A process of replacing defective genes with normal genes. It is achieved by cutting genes from the DNA of healthy cells and inserting them into the DNA of defective cells.

**(ii)**

| Criteria | Marks |
|---|---|
| · Correctly names disease<br>· Provides detailed and knowledgeable discussion | 4 |
| · Correctly names disease<br>· Provides some discussion | 3 |
| · Provides an outline with a correct disease | 2 |
| · Provides a limited outline OR names correct disease only | 1 |

***Possible answer***

Cystic fibrosis involves replacing defective gene with a healthy one in adult somatic cells. Cloning of normal gene in bacteria, followed by insertion into harmless adeno viruses. Virus transfers and inserts DNA segment into nucleus of defective lung cells. DNA is inserted into cell DNA. This done by dripping a solution into the patient's lungs.

**c (i)**

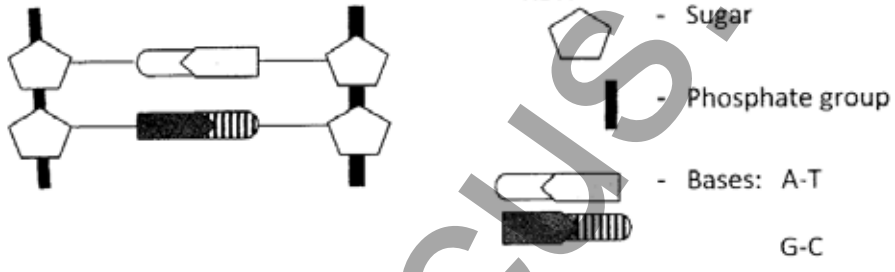
| Criteria | Marks |
|---|---|
| · Provides a clear and sequential outline | 2 |
| · Provides a brief description | 1 |

***Possible answer***
Obtain 2 pipe cleaners, 20 beads and 4 different coloured pegs.
Assign a peg colour to each of the 4 bases - adenine, thymine, guanine and cytosine.
Thread a bead (phosphate group) onto the pipe cleaner (sugar) then a peg (base).
Repeat for 9 more beads/pegs, alternating beads and pegs.
Repeat for a second pipe cleaner, ensuring the peg has its complimentary colour.
Complete and twist the structure to form helix.

**(ii)**

| Criteria | Marks |
|---|---|
| Provides accurate diagram provided with labels | 1 |

***Possible answer***




**(iii)**

| Criteria | Marks |
|---|---|
| · Provides very detailed evaluation of model<br>· Demonstrates a thorough knowledge | 3 |
| · Provides some evaluation of model<br>· Demonstrates a sound knowledge | 2 |
| · Provides an outline of models in science<br>· Demonstrates limited knowledge | 1 |

***Possible answer***
Models are useful in science.
They: - Are a visual aid - simplify concepts - show helical structure - show base pairs
Often: - Oversimplify - doesn't show phosphate group clearly - not to scale
Provided that we are aware of the limitations of this DNA model, it is a useful tool in science that can assist in our understanding.

**d**

| Criteria | Marks |
|---|---|
| · Provides a very detailed history of how species and use has changed<br>· Demonstrates a thorough knowledge | 4 |
| · Provides detailed history of how species and use has changed<br>· Demonstrates a sound knowledge | 3 |
| · Provides limited detail of history of how species and use has changed<br>· Demonstrates some knowledge | 2 |
| · Provides a basic history and/or how species and use has changed<br>· Demonstrates limited knowledge | 1 |

***Possible answer***

Cattle and sheep have been specifically bred for such things as leaner meat, more milk, creamier milk, better quality wool and increased resistance to disease. Pigs, due to selective breeding are less aggressive, have smaller tusks and more meat compared to their genetically similar ancestors.

**e**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of genes in evolutionary relationships<br>· Provides well-supported evaluation of the evidence that analysis of genes provides for evolutionary relationships.<br>· Demonstrates coherence and logical progression of ideas | 7-6 |
| · Demonstrates a sound knowledge of genes in evolutionary relationships<br>· Provides sound evaluation of the evidence that analysis of genes provides for evolutionary relationships<br>· Demonstrates ideas in a clear manner | 5-4 |
| · Demonstrates a basic knowledge of genes in evolutionary relationships<br>· Attempts some evaluation of the evidence that analysis of genes provides for evolutionary relationships<br>· Comminucates ideas in a simple fashion | 3-2 |
| · Provides some relevant information | 1 |

***Possible answer***

There are a number of mechanisms that control the timing of gene expression, Patterns of gene expression are important in evolution. E.g.

- homebox gene, Pax-6, has similar function in eye devlopment of vertebrates and invertebrates alike.
- Genes present for repairing damaged DNA have been conserved from early cells

## Question 33 – THE HUMAN STORY (25 marks)

**a**

| Criteria | Marks |
|---|---|
| · Provides highly detailed description of primates<br>· Demonstrates thorough knowledge | 4 |
| · Provides a detailed description of primates<br>· Demonstrates a sound knowledge | 3 |
| · Provides some description of most of the primates<br>· Demonstrates some knowledge | 2 |
| · Provides limited description of some of the primates<br>· Demonstrates limited knowledge | 1 |

***Possible answer***

| Primate group | Main characteristics of group |
|---|---|
| Apes | forward facing eyes<br>more opposable digits<br>nails<br>coloured stereoscopic vision<br>menstrual cycle<br>lack tail<br>shoulders adapted for brachiation |
| Humans | upright stance<br>bipedal locomotion<br>big toe not opposable, knees are locking, feet are flat<br>pelvis broad<br>legs are longer than the arms<br>live on ground<br>dental arch is parabolic |
| New & Old world Monkeys | larger than prosimians<br>diurnal<br>tree dwellers<br>larger brain than prosimians<br>full binocular vision<br>lack rhinarium |
| Prosiminians | Arboreal<br>presence of nails on at least one digit<br>opposable thumb but less than other primates<br>forward facing eyes but less than other primates |

**b (i)** DNA-DNA hybridisation (1 mark)

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides a highly detailed analysis<br>· Demonstrates a thorough knowledge | 4 |
| · Provides detailed analysis<br>· Demonstrates a sound knowledge | 3 |
| · Provides explanation and/or limited analysis<br>· Demonstrates some knowledge | 2 |
| · Provides an outline<br>· Demonstrates limited knowledge | 1 |

***Possible answer***
DNA-DNA hybridisation has shown that chimpanzees and humans are more similar than chimpanzees compared to gorillas as traditional classification suggests. The latest development has removed the gibbons into their own family, the Hylobatidae.

**c (i)**

| Criteria | Marks |
|---|---|
| · Provides detailed outline | 2 |
| · Provides a description of some of the process | 1 |

***Possible answer***
Preserved and protected dead organism
Bones become fossilised by layers of sediments
Can occur in sediment, sap or ice.

**(ii)**

| Criteria | Marks |
|---|---|
| · Detailed discussion | 3 |
| · Provides a some discussion | 2 |
| · Provides brief explanation | 1 |

***Possible answer***
Relative dating - comparing the fossil with other known fossils. The date reached is relative to the date of another fossil. E.g. stratigraphy, palaeomagnetism and faunal dating.
Absolute dating ages the actual fossil. E.g. dendrochronology, radiocarbon dating, thermoluminescence and potassium-argon dating.

**(iii)**

| Criteria | Marks |
|---|---|
| · Provides detailed outline | 3 |
| · Provides a description or limited outline | 2 |
| · Provides limited description | 1 |

***Possible answer***
- conflicting dates based on different technologies
- the paucity of the fossil record
- different interpretations of the same evidence

**d**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of TWO different models of human evolution in a detailed analysis<br>· Provides well-supported evaluation of TWO different models of human evolution<br>· Demonstrates coherence and logical progression of ideas | 8-7 |
| · Demonstrates a sound knowledge of TWO different models of human evolution in an analysis<br>· Provides sound evaluation of TWO different models of human evolution<br>· Demonstrates ideas in a clear manner | 6-5 |
| · Demonstrates a basic knowledge of at least ONE model of human evolution in a discussion<br>· Attempts some evaluation of human evolution<br>· Comminucates ideas in a simple fashion | 4-2 |
| · Provides some relevant information in a limited discussion | 2-1 |

***Possible answer***

According to anthropologists humans originated from Africa.

1. *Out of Africa* model is a replacement theory where one species was replaced by the modern humans. Any racial differences occurred later. Evidence includes fossil and genetic evidence. For this model to be correct modern humans should appear in Africa earlier. Transitional fossils should only occur in *Africa.*
2. *Regional Continuity Theory* suggests that local evolution occurred in different regions simultaneously. Interbreeding occurred to produce a regional group of *Homo sapiens.* E.g. Modern Chinese developed from the group of *Homo erectus* living in China. For this theory to be supported then modern humans will appear throughout the world at the same time. Transitional fossils should be found everywhere.

## Question 34 – BIOCHEMISTRY (25 marks)

**a**

| Criteria | Marks |
|---|---|
| · Demonstrates a thorough knowledge of photosynthesis and its use in replacing a non-renewable resource in a detailed analysis<br>· Provides well-supported evaluation of the potential use of photosynthesis in replacing a non-renewable resource<br>· Demonstrates coherence and logical progression of ideas | 8-7 |
| · Demonstrates a sound knowledge of photosynthesis and its use in replacing a non-renewable resource in a analysis<br>· Provides sound evaluation of the potential use of photosynthesis in replacing a non-renewable resource<br>· Demonstrates ideas in a clear manner | 6-5 |
| · Demonstrates a basic knowledge of photosynthesis and its use in replacing a non-renewable resource in a discussion<br>· Attempts some evaluation of the potential use of photosynthesis in replacing a non-renewable resource<br>· Comminucates ideas in a simple fashion | 4-3 |
| · Provides some relevant information in a limited discussion | 2-1 |

***Possible answer***

Biomass fuels provide energy for use in cars. Ethanol produced by fermentation of sugars and starches is used or added to petrol. Potential exists to develop this source to replace or prolong petrol use. Currently, large amounts of land would be needed to support the production of biomass to meet the world demand. Large amounts of energy in farming methods would be needed and the process is not viable at present.

**b (i)**

| Criteria | Marks |
|---|---|
| · Provides detailed outline | 2 |
| · Provides limited outline | 1 |

***Possible answer***

Blackman and Mathgel recorded the effects of different carbon dioxide concentrations, light intensities and temperatures in conditions of excess carbon dioxide in cultivated plants. The rate of photosynthesis increased with increasing light intensity.

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides TWO correct observations | 1 |

***Possible answer***

In excess light rate of photosynthesis

- increased with increasing carbon dioxide concentration
- greater at high temperature than at low temperatures.

**(iii)**

| Criteria | Marks |
|---|---|
| · Provides detailed explanation | 2 |
| · Provides limited outline OR limited explanation | 1 |

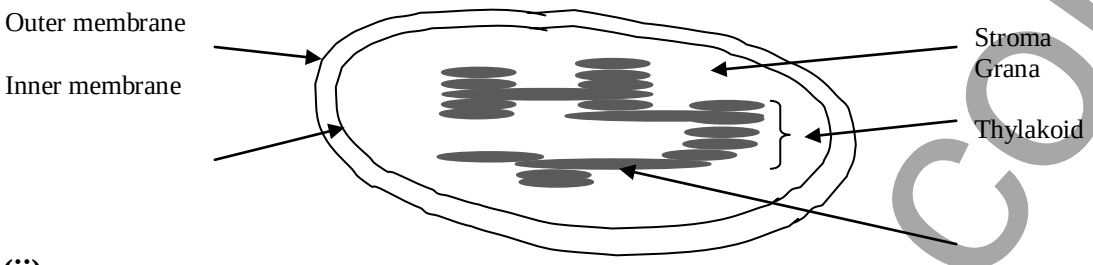
***Possible answer***

Blackman and Mathgel concluded that photosynthesis was a two-stage process. First stage occurs independently of carbon dioxide concentration and temperature and dependent only on light. Whilst second stage was independent of light intensity and dependent on carbon dioxide concentration and temperature.

**c (i)**

| Criteria | Marks |
|---|---|
| · Provides a correctly drawn and labelled chloroplast | 2 |
| · Provides a partly drawn and/or partly labelled chloroplast | 1 |

***Possible answer***




**(ii)**

| Criteria | Marks |
|---|---|
| · Provides a detailed comparison<br>· Demonstrates a thorough knowledge | 4 |
| · Provides some comparison<br>· Demonstrates a sound knowledge | 3 |
| · Provides a limited comparison<br>· Demonstrates some knowledge | 2 |
| · Provides a description of some features in plants<br>· Demonstrates limited knowledge | 1 |

| | ALGAE | TERRESTRIAL ANGIOSPERM | AQUATIC ANGIOSPERM |
|---|---|---|---|
| e.g. | Spirogyra | Grevillia | |
| Size | 6µ | 6µ | 6µ |
| Shape | spiral | disc | Disc |
| Distribution | Found along length of cell | Mostly in palisade and spongey mesophyll | Edges of cells |

**d (i)**

| Criteria | Marks |
|---|---|
| · Provides THREE correct labels | 1 |

***Possible answer***

a = ribose b = phosphodiester bond c = adenosine

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides the correct role for ATP | 1 |

***Possible answer***

ATP provides the energy for cell by transferring a phosphate group to an intermediate. It is then phosphorylated, producing a more reactive molecule.

**(ii)**

| Criteria | Marks |
|---|---|
| · Provides a highly detailed discussion of the nature and organisation<br>· Demonstrates a thorough knowledge | 4 |
| · Provides detailed discussion of the nature and organisation<br>· Demonstrate sound knowledge | 3 |
| · Provides an outline and/or limited discussion of nature and/or organisation<br>· Demonstrates some knowledge | 2 |
| · Provides a limited outline<br>· Demonstrates limited knowledge | 1 |

***Possible answer***

ATP transfers energy. Structurally, ATP consists as an adenine nucleotide joined to 2 other phosphate groups.

Greatest amount of energy is found between the $2^{nd}$ and $3^{rd}$ phosphate.

**2011 TRIAL HIGHER SCHOOL CERTIFICATE**
**BIOLOGY EXAMINATION**

| Question | Marks | Content | Syllabus outcomes |
|---|---|---|---|
| **Section 1 Part A** | | | |
| 1 | 1 | 9.2.3.8 | H13 |
| 2 | 1 | 9.4.3 (3 of 2nd col) | H13 |
| 3 | 1 | 9.4.3.2 | H13 |
| 4 | 1 | 9.3.3.3 | H2, H9 |
| 5 | 1 | 9.3.4.1 | H9 |
| 6 | 1 | 9.4.6.1 | H1, H4, H12 |
| 7 | 1 | 9.3.3.4 | H7 |
| 8 | 1 | 9.3.3.2 | H7 |
| 9 | 1 | 9.4.3.1 | H1, H2, H3, H10 |
| 10 | 1 | 9.3.3.6 | H6, H9 |
| 11 | 1 | 9.2.3.9 | H10 |
| 12 | 1 | 9.2.1.1, 9.2.1(1st of 2nd col) | H2, H12 |
| 13 | 1 | 9.2.3.6 | H6 |
| 14 | 1 | 9.4.3 (2 of 2nd col) | H13 |
| 15 | 1 | 9.2.2.1 | H12, H13 |
| 16 | 1 | 9.3.1.3 | H4, H9, H10 |
| 17 | 1 | 9.2.2 (2 of 2nd col), 9.4.3.2 | H12, H14 |
| 18 | 1 | 9.4.5 | H1, H12.3e |
| 19 | 1 | 9.2.2.3 | H6 |
| 20 | 1 | 9.2.2, 9.4.5.4, 9.3.5.6 | H2, H7, H9 |
| **Section 1 Part B** | | | |
| 21 (a) | 3 | 9.2.3.6 | H6, H12, H13.1e |
| 21 (b) (i) | 3 | 9.2.3.6, 9.2.3.7 | H6 |
| 21(b) (ii) | 1 | 9.2.3.6, 9.2.3.7 | H6 |
| 22 (a) | 3 | 9.3.2 (1st of 2nd col) | H2, H9 |
| 22 (b) | 3 | 9.3.2 (2nd of 2nd col) | H4, H10 |
| 23 | 4 | 9.3.5 (2nd of 2nd col) | H4, H5, H7, H8 |
| 24(a) | 5 | 9.3.4.2, 9.3.4 (1st of 2nd col) | H2, H4, H9, |
| 24(b) | 3 | 9.3.3.5, 9.3.3 (2nd of 2nd col) | H9 |
| 24(c) | 2 | 9.3.3 (1st of 2nd col) | H7, H8, H9, H13.1e |
| 25(a) | 3 | 9.4.3.1 | H1, H12.1a |
| 25 (b) | 1 | 9.4.3.1 | 12.1c |
| 26 (a) | 1 | 9.2.3.6, 9.2.3 (6th of 2nd col) | H12.2b, H12.3 |
| 26 (b) | 3 | 9.2.3.6, 9.2.3 (6th of 2nd col) | |
| 27 (a) | 1 | 9.4.4.4 | H13.1e |
| 27 (b) | 3 | 9.4.4.4 | H6, H13.1e |
| 27 (c) | 4 | 9.4.3 (3rd of 2nd col) | H13.1e, H14.3d |
| 28 (a) | 4 | 9.4.6 (1st of 2nd col) | H8, H14.3d |
| 28(b) | 3 | 9.4.6 (1st of 2nd col) | H12.4e, f |
| 29 (a) | 3 | 9.2.1.5, 9.2.1.6, 9.2.1 (2nd of 2nd col) | H6, H13.1e |
| 29 (b) | 2 | 9.2.1.4, 9.2.1.5, 9.2.1 (2nd of 2nd col) | H6, H12, |

| Question | Marks | Content | Syllabus outcomes |
|---|---|---|---|
| **Section II**<br>**Question 30 - Communication** | | | |
| 30 (a) | 6 | 9.5.2.1 | H13 |
| 30 (b) (i) | 1 | 9.5.7.3, 9.5.7 (3rd of 2nd col) | H2, H6, 13.1e, f |
| 30 (b) (ii) | 2 | 9.5.7.3, 9.5.7 (3rd of 2nd col) | H2, H6, H14.2 |
| 30 (c) (i) | 2 | 9.5.6.7 | H2, H3, H6 |
| 30 (c) (ii) | 4 | 9.5.6.2, 9.5.6 (1st of 2nd col) | H2, H3, H4 |
| 30 (d) (i) | 1 | 9.5.3.5 | H2, H6, H14.2 |
| 30 (d) (ii) | 3 | 9.5.3 (1st of 2nd col), 9.5.3.5, 9.5.3 (2nd of 2nd col), | H3, H6, H14.2 |
| 30 (e) | 6 | 9.5.6 (2nd of 2nd col) | H2, H6, H14.2 |
| **Question 31- Biotechnology** | | | |
| 31 (a) (i) | 3 | 9.6.2 (1st of 2nd col) | H12.1a |
| 31 (a) (ii) | 1 | 9.6.2 (1st of 2nd col) | H12.1b-d |
| 31 (b) (i) | 1 | 9.6.5 (3rd of 2nd col) | H5, H13 |
| 31 (b) (ii) | 2 | 9.6.5 (3rd of 2nd col) | H6, H9 |
| 31 (c) | 4 | 9.6.5 (4th of 2nd col) | H5, H6, H9 |
| 31 (d) | 6 | 9.6.6 (1st of 2nd col) | H3, H4, H7, H10 |
| 31 (e) | 8 | 9.6.7 (1st of 2nd col) | H5 |
| **Question 32 – Genetics: The Code Broken** | | | |
| 32 (a) | 4 | 9.7.3 (1st of 2nd col) | H9, H14.1 |
| 32 (b) (i) | 1 | 9.7.5.1 | H13 |
| 32 (b) (ii) | 3 | 9.7.5 (1st of 2nd col) | H13 |
| 32 (c) (i) | 2 | 9.7.1 (1st of 2nd col) | H2, H11, H12 |
| 32 (c) (ii) | 1 | 9.7.1 (1st of 2nd col) | H2 |
| 32 (c) (iii) | 3 | 9.7.1 (1st of 2nd col) | H12.4d |
| 32 (d) | 4 | 9.7.7.1, 9.7.7 (1st of 2nd col) | H5 |
| 32 (e) | 7 | 9.7.8.4, 9.7.8 (1st of 2nd col) | H14.2d, H14.3 |
| **Question 33 – The Human Story** | | | |
| 33 (a) | 4 | 9.8.1.6 | H10, H13 |
| 33 (b) (i) | 1 | 9.8.1 (3rd of 2nd col) | H3 |
| 33 (b) (ii) | 4 | 9.8.1 (3rd of 2nd col) | H3, H9, H14 |
| 33 (c) (i) | 2 | 9.8.2.1 | H2 |
| 33 (c) (ii) | 3 | 9.8.2.3, 9.8.2.4, 9.8.2.5 | H3, H4, H11, H12 |
| 33 (c) (iii) | 3 | 9.8.2.3, 9.8.2.4, 9.8.2.5 | H14 |
| 33 (d) | 8 | 9.8.3.1, 9.8.3 (1st of 2nd col) | H2, H10, H14 |
| **Question 34 – Biochemistry** | | | |
| 34 (a) | 8 | 9.9.1 (2nd of col 2) | H3, H4, H5, H7, H8, H14 |
| 34(b) (i) | 2 | 9.9.2.4, 9.9.2 (3rd of 2nd col) | H1, H2, H11, H12 |
| 34 (b) (ii) | 2 | 9.9.2.4, 9.9.2 (3rd of 2nd col) | H1, H2, H12.4 |
| 34 (b) (iii) | 2 | 9.9.2.4, 9.9.2 (3rd of 2nd col) | H1, H2, H6 |
| 34 (c) (i) | 2 | 9.9.3.1 | H6 |
| 34 (c) (ii) | 4 | 9.9.3. (4th of 2nd col) | H2, H13.1e |
| 34 (d) (i) | 1 | 9.9.7.1, 9.9.7 (1st of 2nd col) | H13 |
| 34 (d) (ii) | 1 | 9.9.7.1 | H3, H13 |
| 34 (d) (iii) | 4 | 9.9.7.1, 9.9.7.2, 9.9.7 (1st of 2nd col) | H3, H4, H6 |