



THE KING'S SCHOOL

2014
Higher School Certificate
Trial Examination

Biology

Disclaimer:

This is a Trial HSC Examination only. It does not reflect the format and topics of the HSC Examination designed by the NSW Board of Studies for the respective sections.

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Board approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil
- Write your student number at the top of EVERY page
- Use the multiple choice grid provided for your answers to Part A

Total marks – 100

Section I

Total marks (70)

This section has two parts, Part A and Part B

Part A

Total marks (20)

Attempt questions 1 – 20

Allow about 30 minutes for this part

Part B

Total marks (50)

Attempt questions 20 – 32

Allow about 1 hour 45 minutes for this part

Section II - Page 24

Total marks (30)

Attempt ONE question from Questions 33 - 37

Allow about 45 minutes for this section

This paper MUST NOT be removed from the examination room

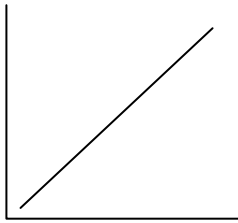
Section I**Part A****Total marks (20)****Attempt questions 1 – 20****Allow about 30 minutes for this part**

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid provided.

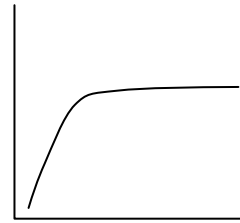
1. The following graphs show the rate of reaction plotted against four factors that affect enzyme performance. Only one graph accurately shows the likely relationship between rate of reaction and concentration of substrate.

Select the graph which is the most accurate representation.

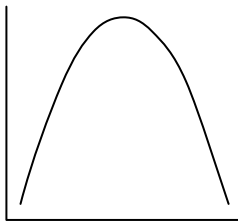
A



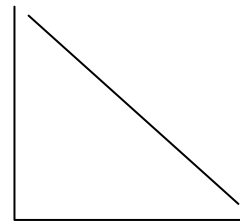
B



C



D



2. A person who received renal dialysis showed the following changes in the chemical composition of their blood. The levels of chemicals before and after dialysis are recorded in the table below.

Chemical in blood	Normal range	Level in blood before renal dialysis	Level in blood after renal dialysis
Blood urea/nitrogen (mg/dL)	10 – 50	102	30
Creatinine (mg/dL)	0.7 – 1.4	11.5	1.4
Sodium (mmol/L)	135 – 138	140	136
Glucose (mg/dL)	70 – 110	100	160

How successful was this dialysis procedure?

- A the procedure was unsuccessful based on the change in the blood urea/nitrogen, creatinine and sodium levels
 - B the procedure was successful based on the change in the blood urea/nitrogen, creatinine and sodium levels
 - C the procedure was successful based on the change in the glucose levels
 - D the procedure was unsuccessful based on the change in the nitrogen levels
3. The concentration of water in blood varies. The body has a homeostatic response to regulate the concentration of water in blood. After exercise a lot of water is lost through sweating. This results in more concentrated urine being produced, as water is being retained by the body to replace the lost fluids. The concentration of blood also increases when fluid is lost.

The hormone that is **directly** responsible for reabsorbing water and preventing it being lost in the urine is:

- A antidiuretic hormone
 - B aldosterone
 - C insulin
 - D catalase
4. Advances in technology have improved artificial blood so that it is similar to donated whole blood in a number of ways.

Which of the following demonstrates this similarity?

- A they both carry oxygen and increase blood volume
- B they both carry oxygen and red blood cells
- C they both contain antinodes and increase blood volume
- D they both contain red and white blood cells and plasma

5. Select the response that correctly matches the way in which carbon dioxide, oxygen and lipids are transported in mammalian blood.

	Carbon dioxide	Oxygen	Lipids
A	carried on haemoglobin in red blood cells	in plasma as ions, also in haemoglobin and as a dissolved gas	dissolved in plasma
B	in plasma as ions, also in haemoglobin and as a dissolved gas	carried on haemoglobin in red blood cells	enclosed in a protein package
C	dissolved as ions only	carried on haemoglobin in red blood cells	dissolved in plasma
D	in plasma as ions, also in haemoglobin and as a dissolved gas	dissolved as ions only	enclosed in a protein package

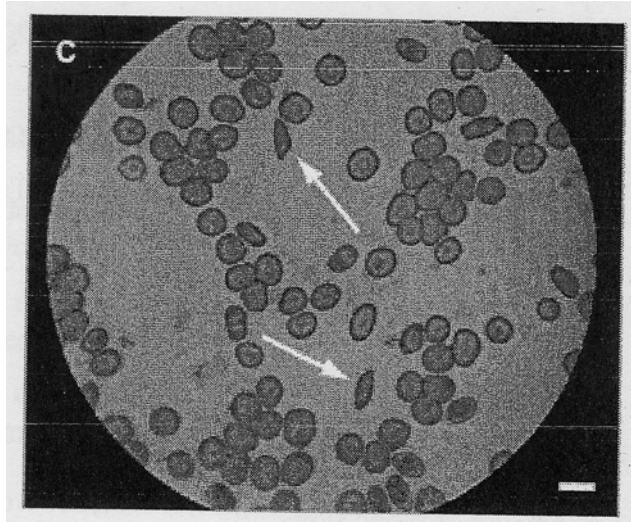
6. A class of Biology students measured the effect of dissolved CO₂ concentration on the pH of distilled water.

Why would a teacher most likely request that a student work with a partner to complete the experiment?

- A to make the experiment more valid and accurate
 - B to complete the task in a more efficient manner
 - C to improve the quality and reliability of their results
 - D to improve the reliability and validity of the experiment
7. Which of the following options correctly matches the type of transport with its process in the kidney?

	Type of transport	Process in the kidney
A	active	collection of urea into kidney tubule
B	active	filtration of waste into Bowman's capsule
C	passive	re-absorption of water from the Loop of Henle
D	passive	uptake of protein from the kidney tubule

8. The photo below shows erythrocytes as seen under a light microscope.

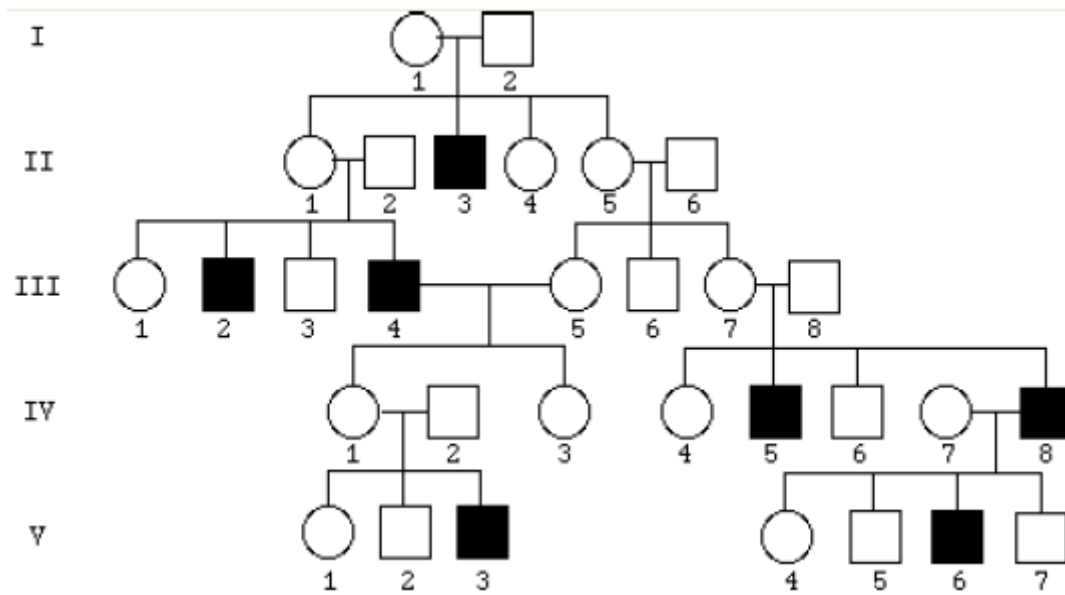


The diameter of the field of view is 0.14 mm

What is the approximate size of a single cell?

- A 80 μm
- B 80 mm
- C 8 nm
- D 8 μm

9. The pedigree below shows how individuals of a large family are affected with a particular condition.



Based on the pedigree, what is the most likely conclusion?

- A the disorder is sex-linked
 - B the gene causing the disorder is dominant
 - C the gene causing the disorder is recessive
 - D the gene causing the disorder is co-dominant
10. A teacher gave a class the following instructions:
- Take 20 yellow toothpicks, 20 red toothpicks, 20 green toothpicks, a stopwatch and a pair of tweezers. Mix up the toothpicks. Go outside and scatter them in a area of grass about one metre squared. One student at a time has 30 seconds to pick up as many toothpicks as he can. Count the colours scatter the toothpicks back onto the area and repeat.

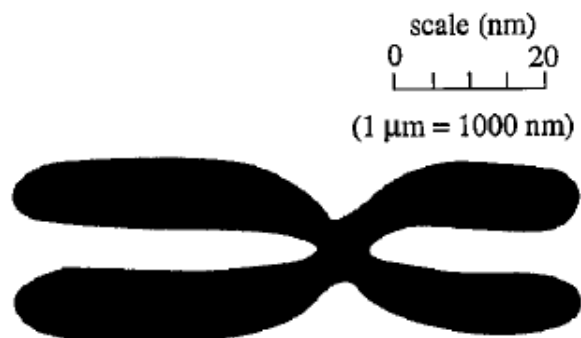
This exercise was to model:

- A the effect of the environment on phenotype
- B natural selection
- C biogeography
- D the expression of genes

11. Gregor Mendel made a great contribution to the study of genetics when investigating heredity in the nineteenth century.

Which of the following was NOT a contribution to his success?

- A he used a large number of plants
 - B the controlled fertilisation of plants
 - C his work was relatively unknown until after his death
 - D he study several characteristics
12. Which of the following scientists is associated with research into sex linkage and chromosomes?
- A Thomas Hunt Morgan
 - B Sutton and Boveri
 - C Beadle and Tatum
 - D Rosalind Franklin
13. A scale diagram of a chromosome is shown below.



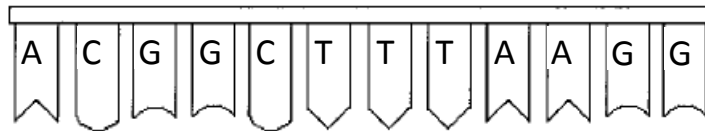
What is the overall length of the chromosome?

- A 0.075 μm
- B 0.75 μm
- C 0.075 cm
- D 0.75 cm

14. Himalayan rabbits are normally white with black ears, nose, feet and tail. The ears, nose, feet and tail have a lower temperature than the rest of the body. However, if a patch of fur is plucked from its back, and an icepack is kept on the plucked patch, the new fur that grows there will be black too.

Which is the best explanation for this observation?

- A that lower temperatures cause mutations in cells which then produce black pigment
 - B the genotype for white fur is affected by lower temperatures
 - C genes for pigment production are switched on at lower temperatures
 - D co-dominant alleles are both expressed in these cooler areas
15. The base sequence for a segment of DNA is shown below.



The table below shows the amino acid that corresponds to mRNA codons.

A		U		G		C	
AAA AAG	Lys	UAU UAC	Tyr	GAA GAG	Glu	CAU CAC	His
AAU AAC	Asn	UGU UGC	Cys	GAU GAC	Asp	CAA CAG	Gln
ACU ACC ACA ACG	Thr	UCC UCA UCG	Ser	GGU GGC GGA GGG	Gly	CGU CGC CGA CGG	Arg

What sequence of amino acids would be produced in this section of the polypeptide?

- A Cys – Arg – Asn – Ser
- B Ser – Arg – Asn – Cys
- C Thr – Gly – Ser – Asn
- D Tyr – His – Lys – Cys

16. In some types of plants, when a red-flowered plant is crossed with a white-flowered plant, the resulting offspring have white flowers with red spots. This is an example of co-dominant inheritance and is shown in the following Punnett square.

Let: R = red flowers
W = white flowers

	W	W
R	RW	RW
W	RW	RW

Choose the option that correctly identifies the genotype and the phenotype of the offspring.

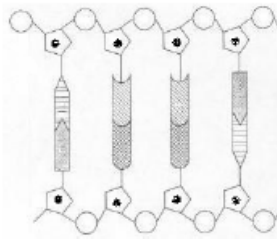
	Genotype	Phenotype
A	pink	RW
B	white flowers with red spots	RW
C	RW	white flowers with red spots
D	RW	pink

17. Some students want to determine if the colour of light affects pea plant growth.

Which of the following is a suitable hypothesis to be tested by the students?

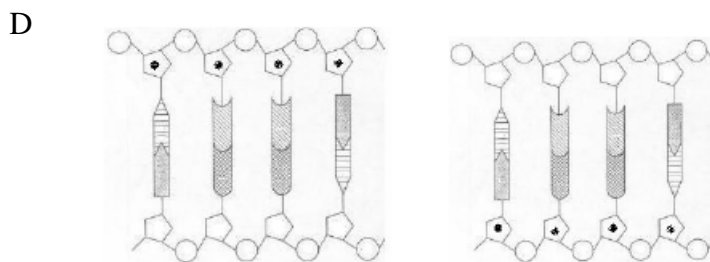
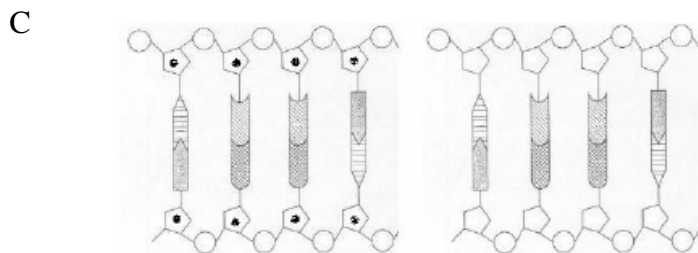
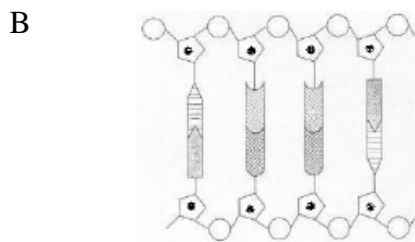
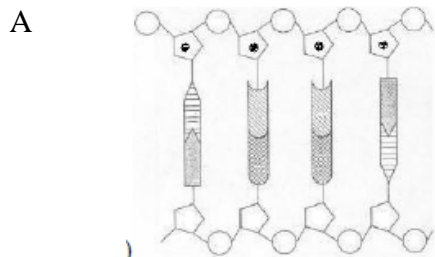
- A all plants will grow better in red light
- B all plants will grow bigger flowers in sunlight
- C pea plants will grow taller in red light than in blue light
- D pea plants will grow faster than bean plants in colour light

18. The diagram depicts a DNA molecules.

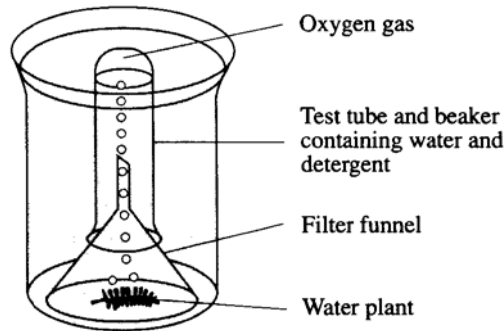


Note: the black dot represents the insertion of a radioactive atom.

Which diagram shows the results after replication of the DNA molecule?



19. In an experiment to find out if detergent affected the amount of oxygen a water plant makes, the equipment shown in the diagram below was used.



A suitable control for this experiment would be set up the same, but would not contain:

- A the water plant
 B the test tube
 C the detergent
 D the water
20. A new treatment for preventing the common cold called Z-11 was tested. Five groups of volunteers each of 1000 people took pills of different strengths for six months.

Group	Contents of pill	Percentage of individuals with colds over the test period
1	sugar	32%
2	sugar and 1 mg Z-11	33%
3	sugar and 2 mg Z-11	33%
4	sugar and 4 mg Z-11	32%
5	sugar and 8 mg Z-11	11%

What is the best conclusion that can be made?

- A Z-11 has little effect on the number of colds
 B sugar lowered the number of colds
 C sugar and Z-11 increased the number of colds
 D an 8 mg dose of Z-11 and sugar work to reduce the number of colds

Part B

Total marks (50)

Attempt ALL questions

Allow about 1 hour 45 minutes for this part

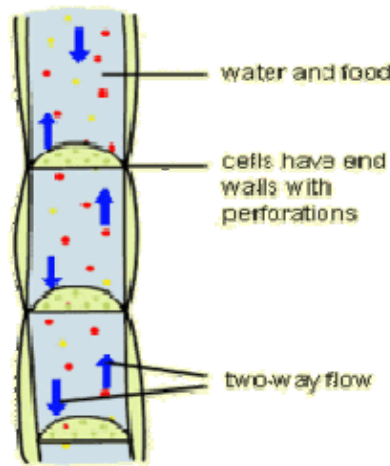
Answer the questions in the spaces provided

Show all relevant working in questions involving calculations.

Question 21 (3 marks)

Marks

The diagram below shows one type of plant tissue associated with the transport of certain substances throughout plants.



State the name of the plant tissue shown in the diagram above and describe ONE theory about the movement of materials in it.

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Question 22 (4 marks)

Marks

In time, plants and animals evolve adaptations to their conditions.

Much of Australia has a hot, dry climate. Using an Australian example for each, explain how the responses of endotherms and ectotherms differ to this climate.

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Question 23 (2 marks)

Blood loses pressure as it moves through the capillaries. This loss of pressure poses a challenge in returning blood to the heart.

Identify the blood vessels that return blood to the heart and describe ONE feature that enable them to perform this function.

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Question 24 (3 marks)

Marks

Complete the diagram below to describe ONE change to the composition of the blood after it leaves each of the three organs indicated. You must select a **different** chemical/compound to discuss for each site.

3

(a) Lungs:

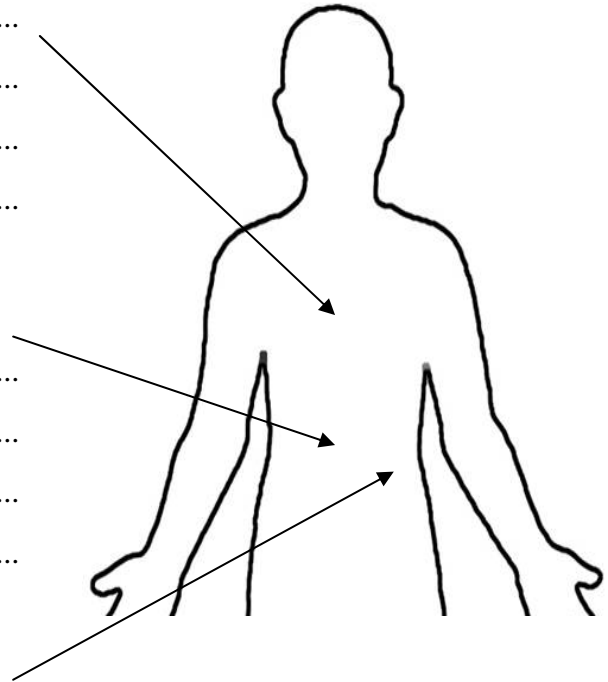
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(b) Liver:

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(c) Kidney:

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Question 25 (6 marks)

Marks

Organisms, whether consciously or not, constantly gain and interpret information from their surrounding environments, so they can respond accordingly.

Discuss this statement, using specific examples, and explain the significance of feedback in the context of survival.

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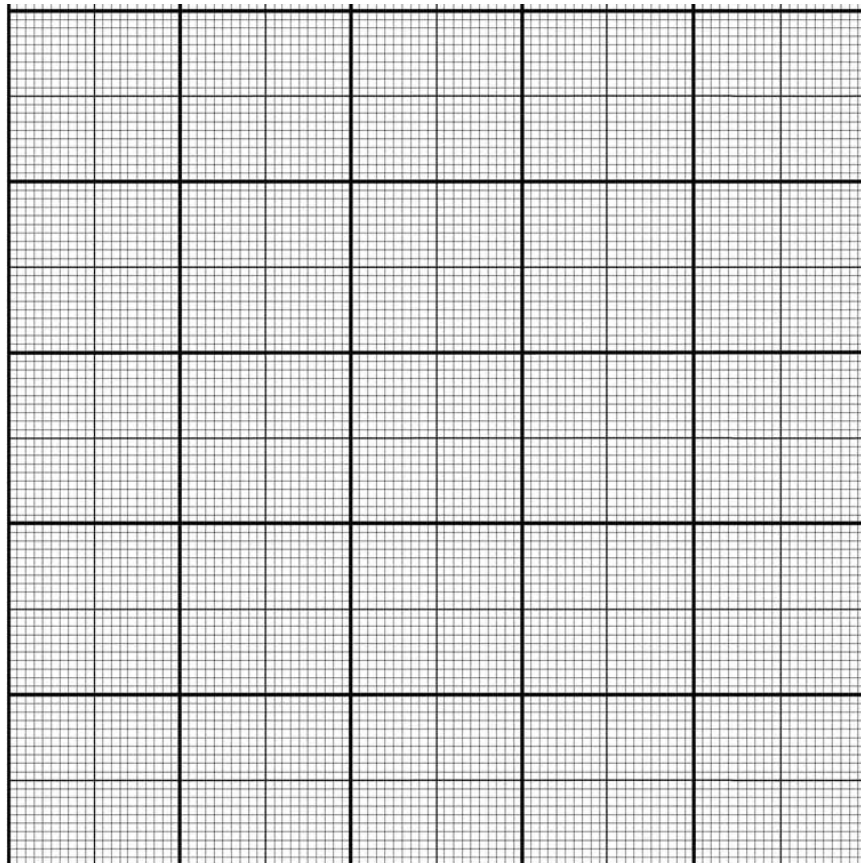
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Question 26 (6 marks)**Marks**

The table below shows the activity of two different enzymes at different levels of acidity.

pH	Activity of enzyme A (% of maximum)	Activity of enzyme B (% of maximum)
1	0	50
2	30	97
3	70	24
4	90	6
5	95	0
6	60	0
7	0	0
8	0	0

- (a) On the same set of axes, plot the activity and draw graphs of each enzyme against pH.

3

Question 26 continues on the next page

Question 26 continued ...

Marks

- (b) One of the enzymes above is in fact a stomach protease, and one is the enzyme glucose oxidase (an enzyme used in respiration). Which enzyme, A or B is the protease? Explain your answer.

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- (d) Identify the *dependent* and *independent* in this investigation.

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Question 27 (5 marks)

Marks

A common way to show the inheritance of characteristics is a pedigree (family tree).

- (a) Draw up a pedigree that illustrates the following information. Show the conventions you have used. **3**

A family had a history of a particular genetic disease. Adrian (male) showed signs of the disease and married Betty who did not display the disease. They had three children, Charles (male), David (male) and Ellen (female). Both Charles and David were genetically healthy, but Ellen may have been a carrier for the disease. Ellen married Freddy (male) who did not have the disease. They had two male children, Geoff (who displayed the disease) and Harry (who was disease-free).

- (b) Could this be a sex-linked disorder? Outline the reasons for your answer. **2**

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Question 28 (6 marks)

Marks

- (a) Explain how Gregor Mendel and Rosalind Franklin contributed to our understanding of genetics.

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- (b) Propose reasons why their discoveries were not fully accepted during their lifetimes.

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Question 29 (3 marks)

Describe ONE method used to produce a transgenic animal.

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Question 30 (3 marks)

Marks

Compare the reproductive technologies of *artificial insemination* and *artificial pollination* and their ability to alter the genetic composition of a population.

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Question 31 (3 marks)

(a) Define *mutation*.

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(b) Discuss evidence for the mutagenic nature of radiation.

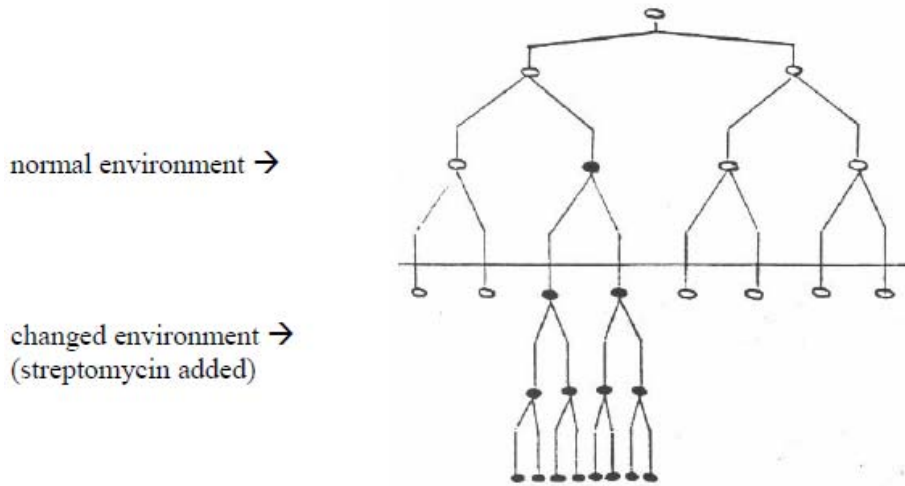
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Question 32 (6 marks)

Marks

The diagram shows what happens over a period of time after one type of *E. coli* cell (white coloured) is placed in a normal environment. *E. coli* is a bacterium. After some time the normal environment is changed by adding a chemical, streptomycin, a common antibiotic.



- (a) State the name of the cell division process by which the bacterium replicates in both types of environment. 1

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- (b) Explain the appearance of the black-coloured bacterial *E.coli* strain in the normal environment. 1

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- (c) Explain how these results support Darwin and Wallace's theory of evolution. 2

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Question 32 continues on the next page

Question 32 continued ...

Marks

- (d) Is the diagram representative of Darwin's theory of gradual evolutionary processes or does it represent punctuated equilibrium evolutionary processes? Explain your answer. **2**

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End of Section I

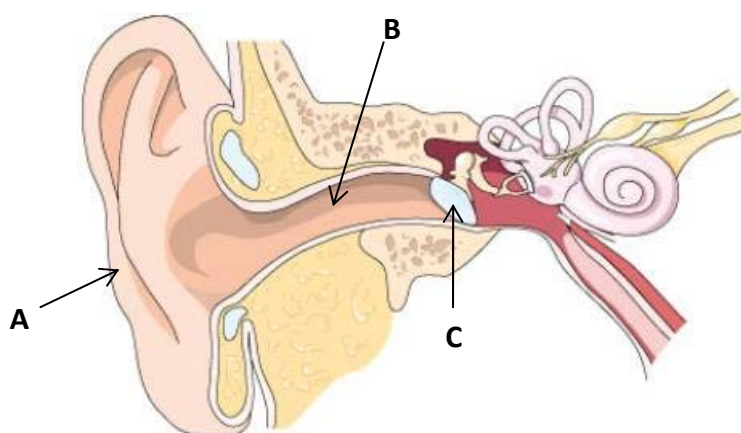
Section II**Total marks (30)****Attempt ONE question from Questions 33 – 37****Allow about 50 minutes for this section**

Answer the question on the writing booklet provided. You may ask for extra booklets if required.

		Pages
Question 33	Communication	25 - 26
<i>Question 34</i>	<i>Biotechnology</i>	
<i>Question 35</i>	<i>Genetics : The Code Broken?</i>	
<i>Question 36</i>	<i>The Human Story</i>	
<i>Question 37</i>	<i>Biochemistry</i>	

Question 33 – Communication (30 marks)**Marks**

- (a) Construct a table to identify the roles of TWO different types of receptors. **3**
- (b) Compare the range of electromagnetic wavelengths detected by humans with the range detected by a named invertebrate. **2**
- (c) Cataract surgery and corneal laser surgery (LASIK) are two technologies that have been developed and used in the modern world.
- Describe ONE of these technologies and assess how the use of this technology has impacted on society. **5**
- (d) (i) Outline the differences in distribution, structure and function of the photoreceptor cells in the human eye. **4**
- (ii) Explain why the brain can perceive many different colours, even though there are only three different types of pigments in the photoreceptor cells that are responsible for colour vision. **2**
- (e) Outline the structure of the human larynx and name ONE other associated structure that assists in the production of sound. **3**
- (f) Identify the structures of the human ear from the diagram shown below. **3**



Question 33 continues on the next page

Question 33 continued...

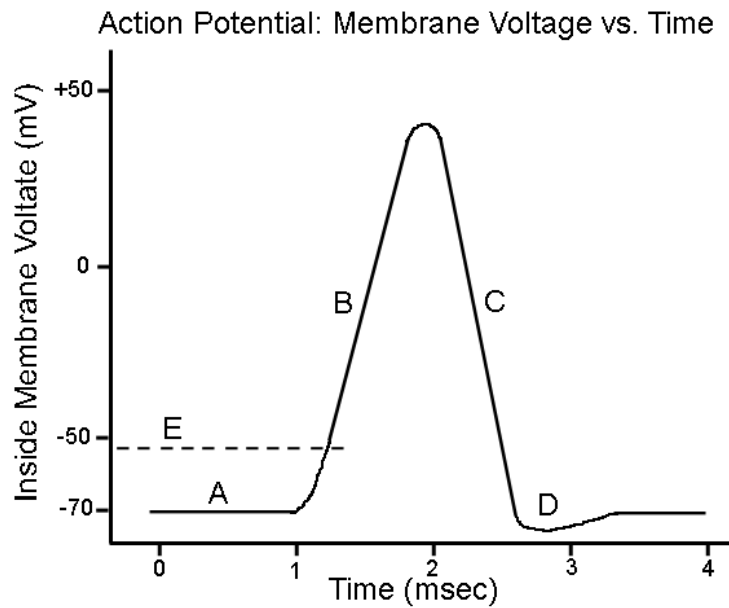
Marks

(g) Identify TWO different devices designed to assist people with hearing challenges and evaluate them in terms of:

4

- (i) the degree to which the technology will assist hearing, and
 (ii) the limitations of each device.

(h) Below is a graph which represents a typical action potential.



Outline what is occurring in the neurone during the labelled stages **B** and **D** on the graph.

4

End of Question 33

End of Paper