

CHEMOLOGY EDUCATION SERVICES

Name: _____

BIOLOGY - Year 12

UNIT 3 TRIAL EXAM 2011

Time allowed: 1 hour 30 minutes

QUESTION AND ANSWER BOOKLET

Structure of booklet

Section	Number of question	Number of questions to be answered
A	25 multiple choice questions	25 multiple choice questions
B	8	8

Directions to students

Materials

Question and answer booklet of 15 pages.
Answer sheet for multiple choice items

The Task

Pleasure ensure that you write your name on the multiple choice answer sheet and this answer booklet.
Answer **all** items from Section A, which should be answered on the sheet provided.
Answer **all** questions from Section B, which should be answered in this booklet in the spaces provided
There is a total of 77 marks available.
All answers should be written in English.

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P O BOX 477 MENTONE 3194
Telephone/Fax 9587 2839 or 0412 405 403 or 0425 749 520

SECTION A – Multiple-choice questions

Instructions for Section A

Answer all questions in pencil on the answer sheet provided for multiple-choice questions.

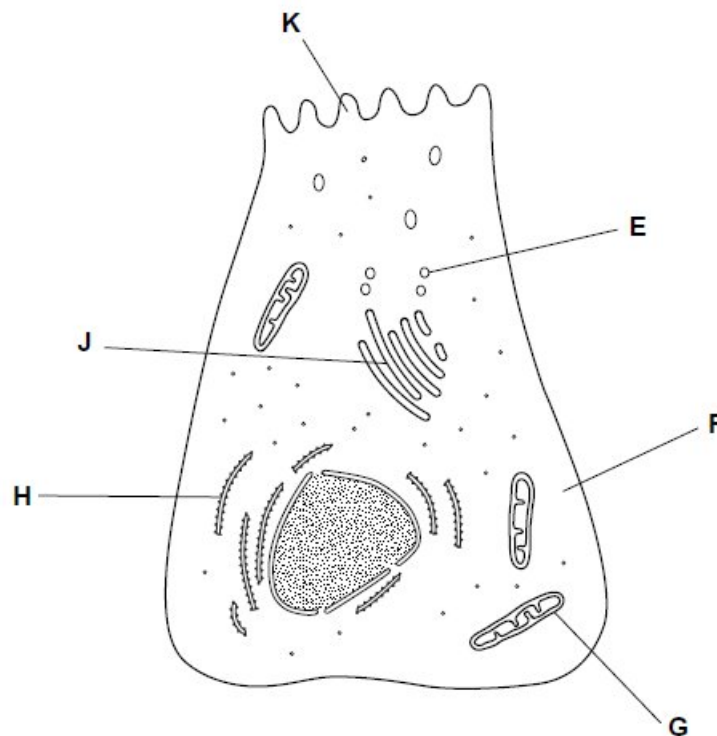
Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question

Refer to the Figure below to answer Questions 1 and 2



Question 1

Organelle G represents a(n)

- A. Ribosome
- B. Mitochondria
- C. Villi
- D. Endoplasmic reticulum

Question 2

The cytoplasm at F contains amino acids. These amino acids are used to make proteins which are secreted from the cell. The correct order showing the passage of an amino acid at F until it is secreted as a protein is:

- A. F – H – J – E – K
- B. F – E – H – J – K
- C. F – J – E – H – K
- D. K – E – J – F – H

Question 3

Vitamins and some minerals act as cofactors in reactions. This means they

- A. Assist the enzyme to function
- B. Lower the activation energy of a reaction
- C. Are a by-product of enzyme controlled reactions
- D. Act as a substrate for the enzyme

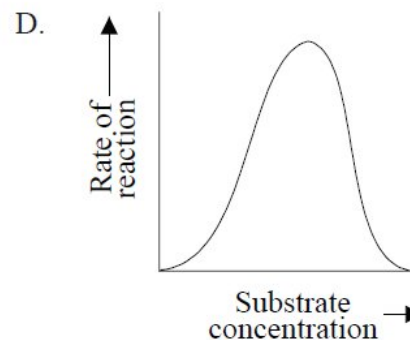
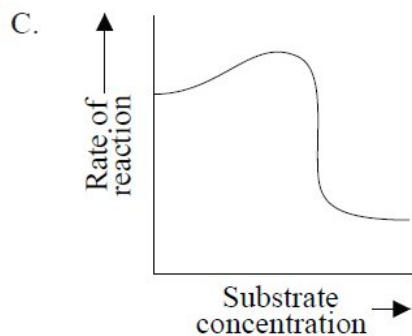
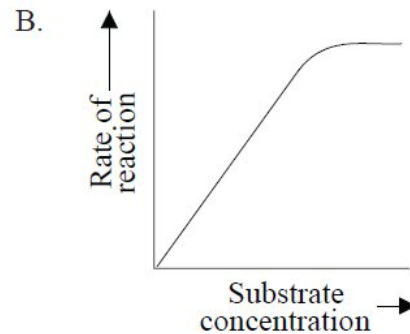
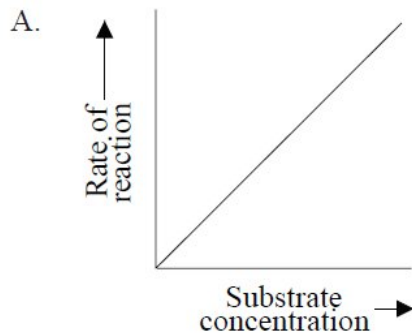
Question 4

The effect enzymes have on activation energy is

- A. No effect
- B. They remove it
- C. They raise it
- D. They lower it

Question 5

The relationship between the rate of an enzyme controlled reaction and the substrate concentration is shown below in Graph___:

**Question 6**

The main structural patterns found in proteins are alpha helices, beta sheets and random coils. These structural patterns make up the protein's

- A. primary structure.
- B. secondary structure.
- C. tertiary structure.
- D. quaternary structure

Question 7

What are pyrimidines in DNA?

- A. Types of nucleotides
- B. Types of sugars
- C. Types of bases
- D. Types of base pairs

Question 8

Common feature of starch and glycogen is that molecules of both

- A. form microfibrils that give support to connective tissue fibres
- B. are important structural components of plant cell walls
- C. are polymers of glucose
- D. are water-soluble disaccharides

Question 9

Which of the following are products of **both** aerobic cell respiration and anaerobic cell respiration **in humans**?

- A. ATP and carbon dioxide
- B. pyruvate and ATP
- C. pyruvate and lactate
- D. lactate and carbon dioxide

Question 10

During the fermentation of glucose to lactate, the net production of ATP, per molecule of glucose is:

- A. None
- B. 2 molecules
- C. 4 molecules
- D. 36 molecules

Question 11

The Calvin cycle occurs in the

- A. Cristae
- B. Matrix
- C. Grana
- D. Stroma

Question 12

Which of the following offers the best description of neural transmission across a mammalian synaptic gap?

- A. Neural impulses cause the release of chemicals that diffuse across the gap.
- B. Neural impulses travel across the gap as electrical currents.
- C. Neural impulses travel across the gap in both directions.
- D. The calcium within the axons and dendrites of nerves adjacent to a synapse acts as the neurotransmitter.

Question 13

Which of the following statements is true about the Krebs (citric acid) cycle and the Calvin (light-independent) cycle?

- A. They both result in a net production of ATP and NADH.
- B. They both require a net input of ATP.
- C. They both result in a release of oxygen.
- D. They both are carried out by enzymes located within an organelle matrix.

Question 14

The bonding of two amino acid molecules to form a larger molecule requires

- A. the release of a water molecule
- B. the release of a carbon dioxide molecule
- C. the addition of a water molecule
- D. an increase in activation energy

Question 15

During replication, the enzyme responsible for removing the RNA primer is

- A. DNA polymerase I
- B. DNA ligase
- C. Helicase
- D. RNA primase I

Question 16

The function of water in photosynthesis is to

- A. absorb light energy
- B. supply electrons in the light-dependent reactions
- C. transport H⁺ ions in the light-independent (dark) reactions
- D. provide O₂ for the light-independent (dark) reactions

Question 17

The table summarises the outcomes of an experiment that examined the effect of ultraviolet radiation on the development of antibiotic resistance in a strain of bacteria.

<i>Treatment</i>	<i>Antibiotic resistance</i>				
	<i>Antibiotic P</i>	<i>Antibiotic Q</i>	<i>Antibiotic R</i>	<i>Antibiotic S</i>	<i>Antibiotic T</i>
No exposure to ultraviolet radiation	✓	✓	✗	✗	✗
Exposure to ultraviolet radiation	✓	✓	✗	✓	✗

✓ = resistant ✗ = not resistant

From the previous Table of results, which of the following statements best summarises the stages in the development of the new strain of bacteria that was resistant to antibiotic S?

- A. Hybridisation - Mutation - Natural Selection
- B. Replication - Mutation - Natural Selection
- C. Mutation - Natural Selection - Replication
- D. Mutation - Hybridisation - Natural Selection

Question 18

An example of a non-specific immune response involves

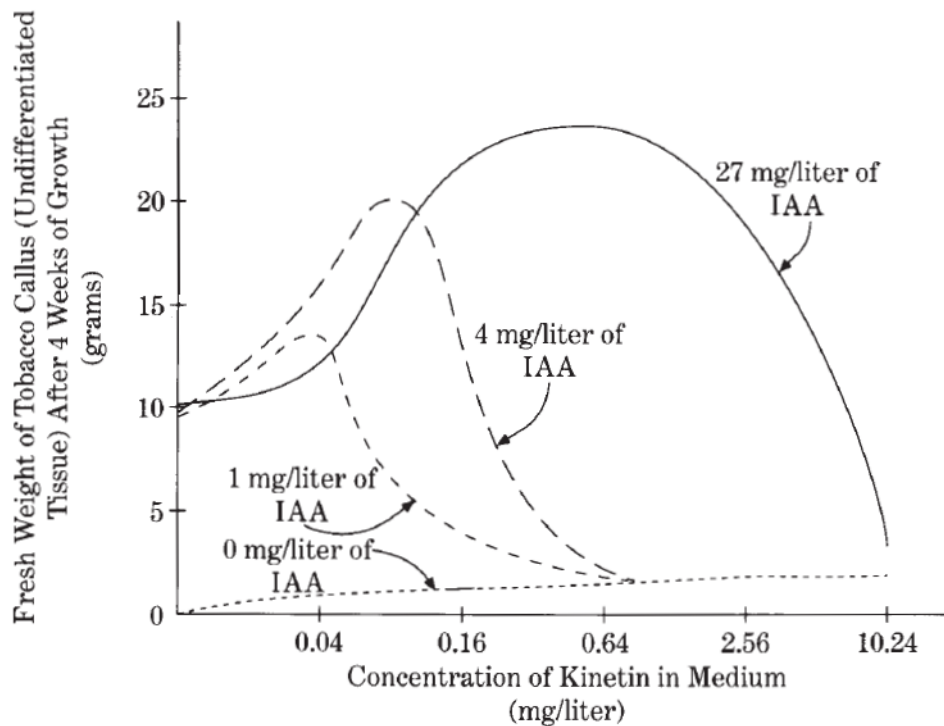
- A. T-cell lymphocytes
- B. Phagocytosis
- C. Antigens
- D. Humoral response

Question 19

For which of these diseases would treatment with antibiotics be most appropriate?

- A. Creutzfeldt-Jacob disease
- B. Influenza
- C. Ringworm
- D. Food poisoning

Questions 20–21 refer to the data presented in the graph below of tobacco cells grown in tissue culture. The numbers on the curves indicate the concentrations of indoleacetic acid (IAA) in milligrams per litre.



Question 20

The optimum concentrations of hormones for promoting maximum tobacco cell growth are

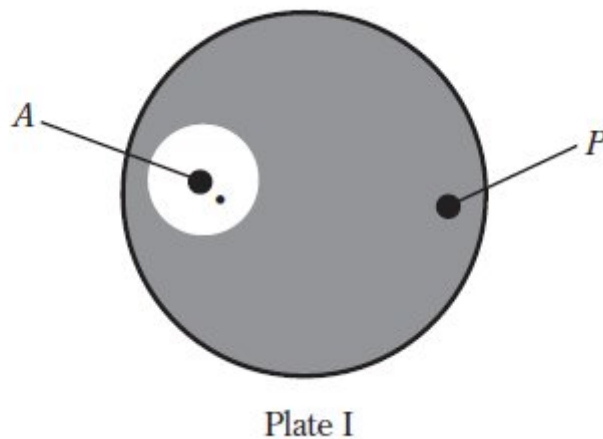
- A. 27 mg/litre of IAA and 2.56 mg/litre of kinetin
- B. 27 mg/litre of IAA and 0.64 mg/litre of kinetin
- C. 4 mg/litre of IAA and 0.64 mg/litre of kinetin
- D. 1 mg/litre of IAA and 0.64 mg/litre of kinetin

Question 21

The purpose of the experiment is primarily to determine the

- A. effect of IAA on the growth of tobacco cells
- B. amount of hormone normally released by tobacco cells in tissue culture
- C. response of tobacco cells in tissue culture to synthetic hormones
- D. response of tobacco cells in tissue culture to combinations of IAA and kinetin

A sterile agar plate, I, is streaked with a pure culture of bacteria by means of aseptic techniques. Paper discs treated with the antibiotics Aureomycin (*A*) and penicillin (*P*) are placed at opposite sides of the plate, as shown in the diagram above. The plate is examined after a 24-hour incubation period, and a clear ring is discovered around disc *A*, but not around disc *P*. Within the clear ring around disc *A*, a single bacterial colony with physical characteristics like those of the pure culture is observed. A second sterile agar plate, II, is then streaked with this single colony and also incubated with antibiotics.

**Question 22**

The single colony found within the clear ring in plate I is most likely made up of the descendants of a bacterial cell that

- A. contaminated the agar plate
- B. contained information conferring resistance to Aureomycin
- C. changed its response to Aureomycin as a result of being exposed to the antibiotic
- D. was susceptible to both penicillin and Aureomycin

Question 23

Which of the following would most likely be observed in plate II after 24 hours?

- A. A clear ring larger than that around disc *A* in plate I would appear around disc *A* only.
- B. A clear ring larger than that around disc *A* in plate I would appear around disc *P* only.
- C. There would be a clear ring around both disc *A* and disc *P*.
- D. There would not be a clear ring around either disc *A* or disc *P*.

Question 24

During the last 50 years, over-use of prescription drugs has led to the emergence of resistant strains of pathogens. Why is this problem?

- A. Many diseases may become untreatable
- B. Resistant pathogens will cause new diseases.
- C. Prescription drugs will cause the release of toxins by pathogens.
- D. A single prescription drug can no longer kill all strains of a pathogen.

Question 25

Doctors have successfully transplanted the fingers of a man's severed hand following a planking stunt that went wrong in which his left arm was severed and right arm crushed when he fell from a balcony through the windscreen of car on the street below. A team of medical staff operated to replace the crushed fingers of his right hand, using those that were saved from his severed left arm. The man is expected to have almost normal use of his hand within one year.

Transplanted organs and tissues are often rejected. Why was there no tissue rejection in the above scenario?

- A. The man's skin was damaged so his first line defences were not functional.
- B. The man lost so much blood that lymphocytes were not present in sufficient numbers to cause an immune response.
- C. Antigens on the man's left hand fingers were the same as those on his right hand
- D. There was no blood supply to the transplanted fingers so mixing of donor and recipient antigens did not occur.

End of Section A

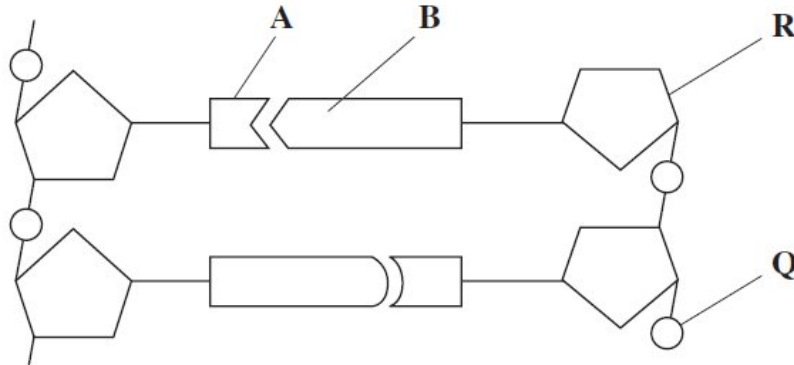
SECTION B – Short answer questions

Instructions for Section B

Answer **all** questions in the spaces provided.

Question 1

The diagram below shows a short section of a DNA molecule



a) Name parts **R** and **Q**.

R _____

Q _____

2 marks

b) The bond that joins A to B is _____

1 mark

Figure 2 shows the sequence of DNA bases coding for seven amino acids in the enzyme ribonuclease.

GTTTACTACTCTTCTTTA

The number of each type of amino acid coded for by this sequence of DNA bases is shown in the table.

Amino acid present	Number present
<i>Asn</i>	1
<i>Gln</i>	1
<i>Met</i>	2
<i>Arg</i>	3

c) Use the table to work out the sequence of amino acids in this part of the enzyme – the first one is given to you.

Sequence: _____ Gln – _____

1 mark

d) Explain how a change in a sequence of DNA bases could result in a non-functional enzyme.

2 marks

Question 2

Gangliosides are lipids found in the cell surface membranes of nerve cells. Hexosaminidase is an enzyme present in blood that breaks down gangliosides. If gangliosides are not broken down, they damage nerve cells.

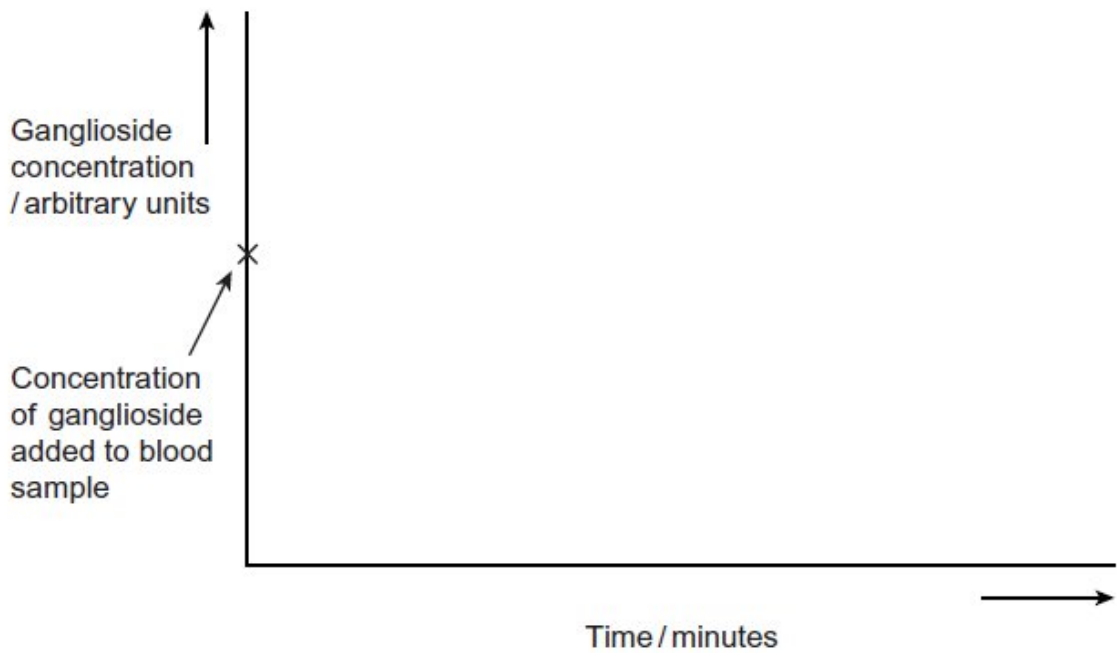
a) Hexosaminidase only breaks down gangliosides. It does not break down other lipids. Explain why this enzyme only breaks down gangliosides.

2 marks

Hexosaminidase is found in the blood of healthy people. People with Tay Sachs disease do not have this enzyme in their blood. Doctors confirm Tay Sachs disease by using a blood test. The technician carrying out the test adds a solution containing a high concentration of gangliosides to a sample of blood from the person being tested. The technician then measures the concentration of gangliosides in the person's blood at regular intervals.

b) Complete the graph over the page by sketching a curve to show the results you would expect for a person with Tay Sachs disease. Label this curve **T**.

1 mark



c) Sketch a curve on the same graph to show the results you would expect for a healthy person who does **not** have Tay Sachs disease. Label this curve **H**.

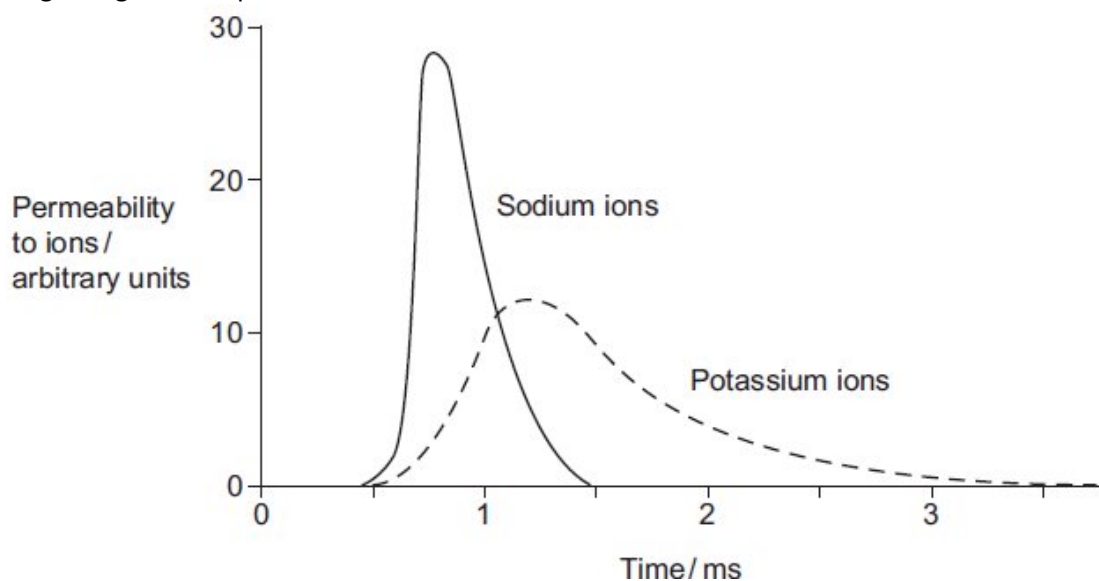
1 mark

d) Scientists are trying to find a way to give the missing enzyme to people with Tay Sachs disease. Suggest why they cannot give the enzyme as a tablet that is swallowed.

1 mark

Question 3

During an action potential, the permeability of the cell-surface membrane of an axon changes. The graph shows changes in permeability of the membrane to sodium ions (Na^+) and to potassium ions (K^+) during a single action potential.



a) Explain the shape of the curve for sodium ions between 0.5 ms and 0.7ms.

1 mark

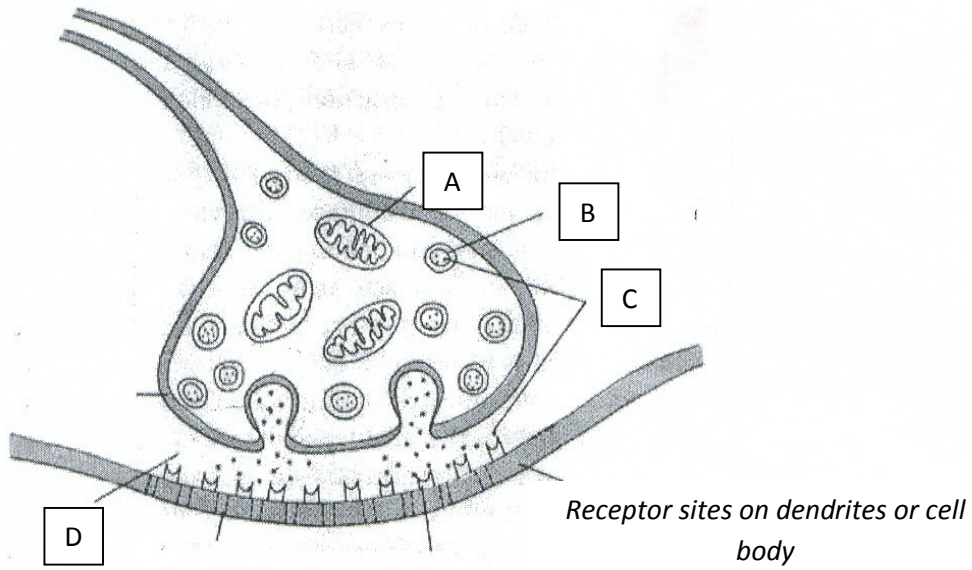
b) During an action potential, the membrane potential rises to +40 mV and then falls. Use information from the graph to explain the fall in membrane potential.

2 marks

c) After exercise, some ATP is used to re-establish the resting potential in axons. Explain how the resting potential is re-established.

2 marks

d) Referring to the Figure, complete the Table underneath



Label	Structure name
A	
B	
C	
D	

2 marks

e) Explain 2 ways the transmission of an action potential across the gap (shown at D) in the Figure could be reduced or stopped

2 marks

Question 4

Homeostasis is characteristic of all living organisms. Sustaining normal blood glucose levels is an important physiological parameter that is maintained in humans.

a) What is a hormone?

1 mark

- b) Using a stimulus response model, outline the bodily responses for maintaining blood-glucose levels when an increase of blood glucose levels occurs.

4 marks

- c) Many sports drinks have a high concentration of glucose and minerals. Outline the effectiveness of sports drinks in view of their high concentrations of ions and the effect of exercise on water balance.

2 marks

Question 5

- a) Discuss the production of energy during aerobic respiration from pyruvate that has been produced by glycolysis in regards to
 - a. Krebs Cycle

2 marks

- b. Electron transfer chain

2 marks

- b) Write out the complete balanced equation for aerobic respiration

2 marks

Question 6

Taxol is a drug used to treat cancer. Research scientists investigated the effect of injecting Taxol on the growth of tumours in mice.

Number of days of treatment	Mean volume of tumour (mm³)	
	Control group	Experimental group (injected with taxol in saline)
1	1	1
10	7	2
20	23	11
30	44	20
40	114	48
50	372	87

- a) Suggest how the scientists should have treated the control group

1 mark

b) Suggest and explain **two** factors which should be considered when deciding the number of mice to be used in this investigation.

2 marks

c) The scientists measured the volume of the tumours. Explain the advantage of using volume rather than length to measure the growth of tumours.

1 mark

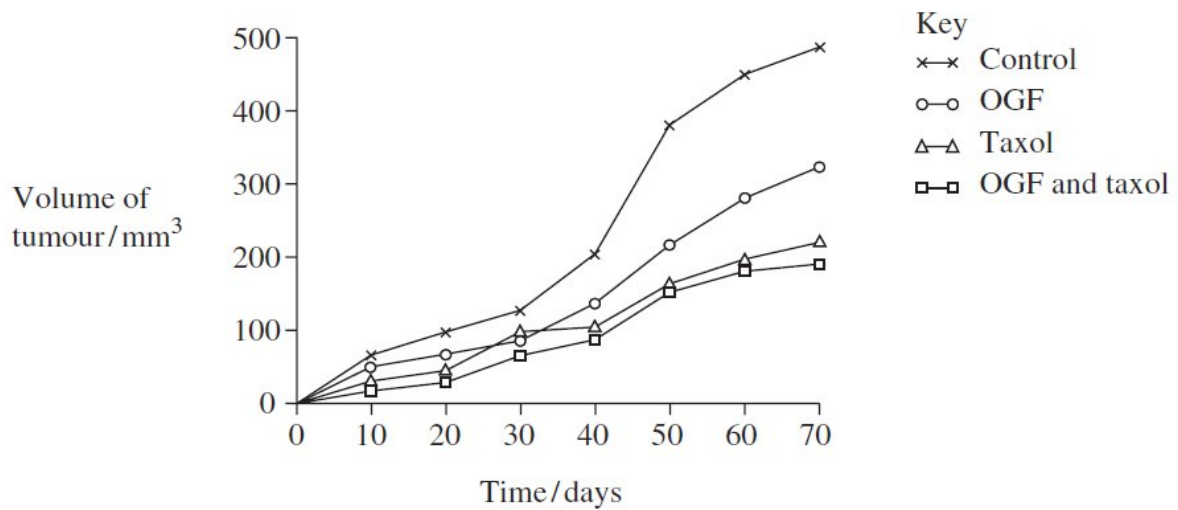
d) The scientists concluded that taxol was effective in reducing the growth rate of the tumours over the 50 days of treatment. Use suitable calculations to support this conclusion.

2 marks

e) In cells, taxol disrupts spindle activity. Use this information to explain the results in the group that has been treated with taxol.

1 mark

The research scientists then investigated the effect of a drug called OGF on the growth of tumours in mice. OGF and taxol were injected into different mice as separate treatments or as a combined treatment. The Graph and the Table below show the results from this second investigation.



Treatment	Mean volume of tumour following 70 days treatment (mm ³)
OGF	320
Taxol	209
OGF and taxol	188
Control	496

f) Use the results to evaluate the effectiveness of the two drugs when they are used separately and as a combined treatment

3 marks

Question 7

SCID is a severe inherited disease. People who are affected have no immunity. Doctors carried out a trial using gene therapy to treat children with SCID. The doctors who carried out the trial obtained stem cells from each child's umbilical cord.

- a) Give **two** characteristic features of stem cells.

2 marks

The doctors mixed the stem cells with viruses. The viruses had been genetically modified to contain alleles of a gene producing full immunity. The doctors then injected this mixture into the child's bone marrow. The viruses that the doctors used had RNA as their genetic material. When these viruses infect cells, they pass their RNA and two viral enzymes into the host cells.

- b) One of the viral enzymes makes a DNA copy of the virus RNA. Name this enzyme.

1 mark

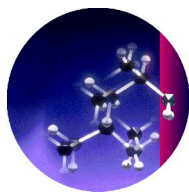
- c) The other viral enzyme is called integrase. Integrase inserts the DNA copy anywhere in the DNA of the host cell. It may even insert the DNA copy in one of the host cell's genes. The insertion of the DNA copy in one of the host cell's genes may cause the cell to make a non-functional protein. Explain how.

2 marks

- d) Five out of the 20 children in the trial developed cancer. Although the cancer was treated successfully, the doctors decided to stop the trial in its early stages. How might the insertion of the DNA have caused cancer?

2 marks

END OF EXAM



CHEMOLOGY EDUCATION SERVICES

Name: _____

MULTIPLE CHOICE ANSWER SHEET

Shade the box after the letter corresponding to your answer.

- | | | | | | | | | | |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|-----|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 13. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 2. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 14. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 3. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 15. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 4. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 16. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 5. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 17. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 6. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 18. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 7. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 19. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 8. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 20. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 9. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 21. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 10. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 22. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 11. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 23. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| 12. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> | 24. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |
| | | | | | 25. | A <input type="checkbox"/> | B <input type="checkbox"/> | C <input type="checkbox"/> | D <input type="checkbox"/> |



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SUGGESTED SOLUTIONS TO 2011 BIOLOGY TRIAL EXAM 1

Multiple Choice Section:

1	B
2	A
3	A
4	D
5	B
6	B
7	C
8	C
9	B
10	B
11	D
12	A

13	D
14	A
15	A
16	B
17	C
18	B
19	D
20	B
21	D
22	B
23	D
24	A
25	C

Short Answer Question

Question 1

- a) R = Deoxyribose (1 mark) Q = Phosphate/Phosphoric acid (1 mark)
- b) Hydrogen (bonds) (1 mark)
- c) (Gln) Met –Met- Arg- Arg- Arg- Asn (1 mark)
- d) Change in a sequence of DNA can led to a change in (sequence of) amino acids/primary structure (1 mark). It can also alters tertiary structure/active site (of enzyme) so that substrate cannot bind and no enzyme-substrate complexes form (1 mark)

Question 2

- a) Hexosaminidase only breaks down gangliosides due to its active site (1 mark). The enzyme has a complementary/structure or shape that only binds to gangliosides (1 mark). This forms enzyme-substrate complexes.
- b) No change to graph. Substrate remains high - horizontal line (1 mark)
- c) Curve decreases rapidly at first then more slowly (1 mark)
- d) Enzymes are proteins and will be digested and destroyed by enzymes acid (1 mark) **OR** Enzymes are too large to cross cell membranes and be absorbed into the bloodstream (1 mark)

Question 3

- a) Ion channel proteins open and sodium crosses in (1 mark)
Changes membrane potential and makes inside undergo depolarisation and reach threshold (1 mark)
- b) Potassium channels open and potassium out (1 mark)
Sodium channels close (1 mark)
- c) Using active transport, pumped against concentration gradient (1 mark)
- d)

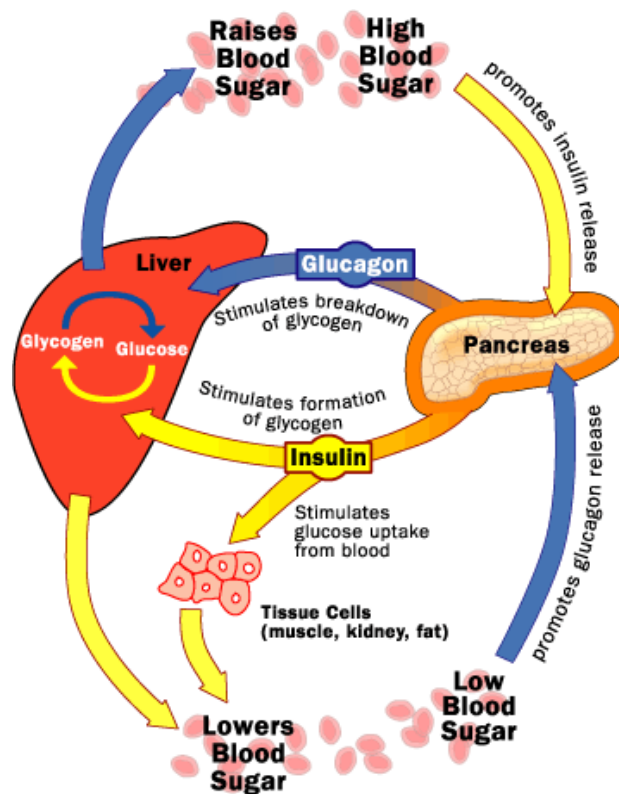
A	Mitochondria
B	Vesicle
C	Neurotransmitter
D	Synaptic Gap

½ mark each - Total 2 marks

- e) An inhibitor could block/compete with transmitter for the receptor site (1 mark)
An anaesthetic stops transmission by blocking the receptor site (1 mark)

Question 4

- a) A hormone is a chemical involved in the regulation of many body processes. (1 mark) They are produced in endocrine glands and exert an effect on specific body tissues, often referred to as target tissues.
- b) Example of stimulus response model
1 mark for showing high blood sugar results in insulin release
1 mark for showing insulin is released from pancreas
1 mark for showing insulin stimulates the formation of glycogen – in liver (thus lowering blood glucose levels)
1 mark for showing insulin stimulates glucose uptake from blood (thus lowering blood glucose levels).
Refer to a simple diagram below – yellow



- d) Sports drinks contain high concentration of glucose and minerals. The sports drink would increase the concentration of ions and therefore the person would become thirstier. (1 mark)

Question 5

- a) *Krebs cycle occurs* in matrix of mitochondrion (1 mark) It is where oxidation or the removal of hydrogen by NAD and FAD occurs (1 mark).
- b) *Electron transport chain involves the* transfer of hydrogen to inner membrane carriers (1 mark). Hydrogen ion pumped across inner membrane which creates a concentration gradient and electron transferred between carriers (1 mark). OR Hydrogen ion passes down concentration gradient, through ATPase complex and oxygen is final acceptor forming water (1 mark). Maximum of 2 marks
- c) *Aerobic respiration*

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 36-38ATP$$

Question 6

- a) Given only saline - otherwise treated exactly the same way (1 mark)
- b) Ethical consideration, e.g., any of – causes physical/psychological harm – leads to death/suffering of mice; large number to improve reliability / reduce sampling error; number of mice related to cost/space available (1 mark)
- c) Tumours vary in shape - they do not grow uniformly (1 mark)
- d) (Percentage decrease) 76.6%; (Percentage decrease) 76.8% (1 mark in total)
- e) A reference to Mitosis should be provided - As chromosomes cannot attach (to spindle)/the chromatids cannot separate (on spindle). The cell division/cell cycle slows down (1 mark)
- f) Both chemicals (on their own) slow down growth/are effective; Taxol is more effective than OGF; Combined treatment (seems) most effective; SD overlap for OGF with taxol and taxol (on its own) so not conclusive/could be chance/both treatments could be equally effective;

Question 7

- a) Stem cells are unique as they will replace themselves and relocate replicate. They are considered to be undifferentiated, which means they can develop into other cells – totipotent (1 mark).
- b) Reverse transcriptase (1 mark)
- c) Causes different sequence of amino acids in protein/primary structure and can alter tertiary structure. (1 mark)
- d) Affects tumour suppressor gene, therefore inactivates (tumour suppressor) gene (1 mark)