**BIOLOGY – FORM V**  
TIME: 2 HOURS

NAME: _____________________________  
CLASS: _____________________________

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<td><strong>Max mark</strong></td>
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<td><strong>TOTAL MARK</strong></td>
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<tr>
<th></th>
<th>85% Theory Paper</th>
<th>15% Practical</th>
<th>100% Final Score</th>
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**85% Theory Paper**  
**15% Practical**  
**100% Final Score**
Section A

Answer ALL questions in this section.

1. The following diagram shows TWO different karyotypes (A & B). A karyotype describes the number of chromosomes and what they look like under the light microscope.

A

B
a. Compare the number of chromosomes in karyotypes A and B.

____________________________________________________________________ (1 mark)
b. Name the type of mutation leading to the karyotypes A and B.

____________________________________________________________________ (1 mark)
c. Name the site in the cell where chromosomes are located.

____________________________________________________________________ (1 mark)
d. Compare the sex chromosomes of a normal female and normal male.

____________________________________________________________________ (1 mark)
e. Down’s syndrome is a genetic disorder caused by the presence of a third copy of chromosome 21. Write the number of chromosomes in the karyotype of a Down’s syndrome individual.

____________________________________________________________________ (1 mark)

Total: 5 marks

2. Fatty liver disease is a reversible condition where large vacuoles of fat accumulate in liver cells. This disease is typical in obese persons.

a. Compare the vacuoles in plant and animal cells.

____________________________________________________________________

____________________________________________________________________ (1 mark)

b. The Adjustable gastric banding is a surgery designed for obese patients. This involves placing a silicone band (commonly known as the A band) around the top part of the stomach. The following diagram shows the A band surgery.

i. Name the acid produced in the stomach.

____________________________________________________________________

ii. Label parts X and Y shown in the diagram above.

X: ____________________________  Y: ____________________________
iii. Explain the advantage of using the A band to treat obesity.

_________________________________________________________________________  (1, 2, 1 mark)

c. Obese individuals have a higher risk of suffering from the presence of gall stones in the gall bladder. Name the substance stored in the gall bladder.

_________________________________________________________________________________________  (1 mark)

**Total: 6 marks**

3. Varicocele is an enlargement of the veins within the scrotum. Varicocele is a common cause of low sperm production and decreased sperm quality.

a. Name the organ contained inside the scrotum.

_________________________________________________________________________________________  (1 mark)

b. Write the scrotum temperature in human beings.

_________________________________________________________________________________________  (1 mark)

c. Describe the possible consequence of low sperm production and decreased sperm quality.

_________________________________________________________________________________________  (1 mark)

d. Recent research studies provide increasing evidence that the harmful products of tobacco smoking kill sperm cells. Therefore governments are urging manufacturers to put warnings on cigarette packets to inform smokers about this effect of cigarette smoking. Write ONE other warning message that you would recommend.

_________________________________________________________________________________________  (1 mark)

e. The research also indicates that harmful chemicals in cigarettes interfere with the production of oestrogen in females.

i. In underweight females there is insufficient production of oestrogen. Describe ONE possible consequence of the insufficient (low) production of oestrogen.

_________________________________________________________________________________________ (1 mark)

ii. Underweight individuals are advised to eat calorie-dense foods such as dried fruit and cheese. Explain ONE nutritional benefit of dried fruits and cheese.

Dried fruits:  

Cheese:  

_________________________________________________________________________________________  (1, 2 marks)

**Total: 7 marks**
4. The following diagram shows four (A, B, C and D) different brain injuries. The white areas indicate the brain injury site.

![Brain Diagram]

a. Write the letter representing the brain injury that would affect:

i. breathing and heart rate  ___________________
ii. speech  ___________________
iii. balance, movement and posture.  ___________________ (1, 1, 1 mark)

b. Describe ONE way how the brain is protected in the human body.

____________________________________________________________________ (1 mark)

c. Head injuries can cause blood clots to form in the brain. Explain how blood clots in the brain affect the blood flow in brain arteries.

____________________________________________________________________
____________________________________________________________________ (2 marks)

d. Pulmonary embolism is caused by blood clots that travel to the pulmonary arteries from another part of the body, most commonly the legs. Describe ONE symptom of pulmonary embolism.

____________________________________________________________________ (1 mark)
e. A patient was suffering from pulmonary oedema. In pulmonary oedema fluid accumulates in the air spaces of the lungs leading to impaired gas exchange.

i. List TWO factors affecting the rate of gas exchange.

_________________________________________________________________________
_________________________________________________________________________

ii. Compare the gas exchange process taking place during respiration and photosynthesis.

_________________________________________________________________________
_________________________________________________________________________

(2, 2 marks)

Total: 11 marks

5. X-linked ichthyosis (XLI) is a skin condition caused by the hereditary deficiency of a particular enzyme. The syndrome is a recessive X-linked condition. The letter H represents the normal allele while h represents the XLI allele. The following diagram shows the inheritance of the condition in a particular family tree.

<table>
<thead>
<tr>
<th>Key:</th>
<th>Normal male</th>
<th>Affected male</th>
<th>Normal female</th>
<th>Affected female</th>
</tr>
</thead>
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<td></td>
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</table>

a. Name:

i. the outermost layer of skin

_________________________________________________________________________

ii. ONE type of receptor present in skin.

_________________________________________________________________________

(1, 1 mark)

b. Write the genotypes of:

i. Clare: _______________  ii. Steve: _______________  (1, 1 mark)

c. Ruth and Vince were informed by the genetic counsellor that their children will never be affected by the condition. Write the genotype of Ruth.

Ruth: _______________  (1 mark)
d. Noel and Emily are expecting their first child. The genetic counsellor informed the couple that they can have an affected son but not an affected daughter. In the space below draw a genetic diagram to determine the percentage chance of having an affected son.

(4 marks)

Total: 9 marks

6. A group of biology students visited a local fish farm. Following their site visit the students conducted an experiment to investigate how the number of fish in a water tank affects the concentration of oxygen. The following diagram shows the equipment used.

a. Describe ONE advantage of fish farming.

____________________________________________________________________

(1 mark)

b. List ONE factor that needs to remain constant throughout the investigation.

____________________________________________________________________

(1 mark)

c. Describe ONE precaution that the students should take when conducting the investigation.

____________________________________________________________________

(1 mark)
d. Predict how an increased number of fish affects the oxygen concentration.

____________________________________________________________________

(1 mark)

e. Describe ONE method that can be used in the fish farm to ensure adequate oxygen levels in the water tanks.

____________________________________________________________________

(1 mark)

f. Sea lice are common ectoparasites present in fish farms that cause fish disease.

i. Define the term *ectoparasite*.

____________________________________________________________________

ii. Describe how the number of fish present in a water tank affects the spread of disease.

____________________________________________________________________

(1, 1 mark)

g. Explain how the accumulation of the excretory products of fish in the water tank affects the oxygen concentration in the tank.

____________________________________________________________________

____________________________________________________________________

(2 marks)

**Total: 9 marks**

7. Etiolation is a process of flowering plants grown in partial or complete absence of light. It is characterised by long weak stems, smaller sparser leaves due to longer internodes and a pale yellow colour.

a. Explain why leaves from an etiolated plant are pale yellow.

____________________________________________________________________

(1 mark)

b. In the space draw a simple diagram to illustrate the internode position in a plant.

____________________________________________________________________

(1 mark)

c. Describe how etiolation response of germinating seedlings is a beneficial adaptation in the natural environment.

____________________________________________________________________

____________________________________________________________________

(2 marks)
d. Etiolation in plants is due to auxins (plant growth hormones). A biology student conducted an experiment about the effects of auxins on the growth of a wheat coleoptile. In the experiment auxin was mixed with some lanolin (lanolin is a grease that sticks to plant surfaces). A blob of the mixture of lanolin and auxin was stuck to one side of a coleoptile as shown in the diagram below. During the experiment even lighting was used. The diagram also shows the four (A, B, C & D) possible results of the experiment.

![Diagram showing experiment setup and possible results A, B, C, D.]

i. Write the letter representing the expected result. Give a reason for your answer.

_________________________________________________________________________
_________________________________________________________________________

ii. Describe the position of lanolin with auxin mixture that would produce result D.

_________________________________________________________________________

(2, 1 mark)

e. The biology student decided to repeat the whole experiment and include a coleoptile in which a blob of lanolin only is used (without any auxin present). Explain the benefit of including a coleoptile with a blob of lanolin only in this investigation.

_________________________________________________________________________

(1 mark)

Total: 8 marks
Section B

Answer any THREE questions from this section. Answer the questions of Section B on a foolscap.

1. Pesticides have been identified as one of several factors which may be responsible for the decline in the bee population. The EU has banned three insecticides.
   a. Define the term *population.*
      (2 marks)
   b. i. List ONE other factor that can lead to the decline of the bee population besides pesticides.
      ii. Describe TWO alternative solutions to the use of persistent pesticides.
         (2, 2 marks)
   c. Pesticides in soil hinder the process of nitrogen fixation.
      i. Name the type of plants that farmers sow in fields to enhance the nitrogen-fixing process.
      ii. Name ONE other type of bacteria that increase the soil nitrogen content.
      iii. Pesticides bind strongly to soils that are high in clay. Compare the texture of clay soil in wet and dry conditions.
         (1, 1, 2 marks)
   d. Explain why a decline in the bee population affects farmers.
      (2 marks)
   e. Research studies indicate that pesticide exposure increases the risk of cancers particularly leukaemia. Leukaemia is characterised by a lack of blood platelets.
      i. Describe ONE consequence of a lack of blood platelets.
      ii. Name the site in the human body where platelets are produced.
         (2, 1 mark)
      Total: 15 marks

2. The Joshua tree is one of the most characteristic plants of the Mohave desert in California. The Joshua tree is a monocotyledonous plant.
   a. List TWO structural features of monocots.
      (2 marks)
   b. Many animals such as lizards make their homes in Joshua trees. Some lizard species are capable of shedding part of their tail. Explain the benefit of this adaptation.
      (1 mark)
   c. The White fir is a conifer typically found in the mountains of Western America. A biology student remarked that conifers have naked seeds. Explain.
      (2 marks)
   d. The jackrabbit is a herbivorous hare typically found in the desert while the arctic hare lives in the Arctic region. Name the hare that you would expect to have larger ears. Give a reason for your answer.
      (3 marks)
e. A biology student described the feeding interactions between a number of organisms living in the Mohave desert.

The jackrabbit prefers grasses and the herbaceous flowering plant. Hawks, rattlesnakes and coyotes are the main predators that hunt jackrabbits. Rattlesnakes fall prey to hawks. Rattlesnakes feed primarily on lizards. Lizards are predominantly insectivorous. The mountain lion is the main predator of coyotes that in turn feed on mice and ground squirrels. Mice and ground squirrels feed on seeds and plant shoots.

From the information above name:

i. TWO primary consumers

ii. TWO secondary consumers

iii. the trophic level in which the mountain lion is found. (2, 2, 1 mark)

f. Desert animals are well adapted to avoid heat. Describe ONE behavioural adaptation of desert animals to avoid heat. (2 marks)

Total: 15 marks

3a. The Apple Scab is a serious disease of apple trees. The fungal disease forms yellow spots on the surface of leaves, buds or fruit.

i. Name the location where spores can be found in a fungus.

ii. Most fungal and plant spores are haploid. Write the term that describes the haploid cells in human beings that fuse together during fertilisation.

iii. Write the term that describes the tangled hyphae present in a fungus. (1, 1, 1 mark)

b. Apples are used to make apple cider by the process of fermentation. Describe the process of fermentation. (3 marks)

c. A recent study suggests that individuals who eat at least one apple a day are less likely to develop diabetes.

i. Name the TWO hormones that control the level of blood glucose.

ii. Name the substance present in the urine of a diabetic person but not present in the urine of a non-diabetic.

i. Urea is always present in urine. Name the artery with a high concentration of urea. (2, 1, 1 mark)
d. The following table shows the death rate caused by diabetes in males in Malta from 2008 to 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>Death rate in Males (by 100,000 inhabitants)</th>
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<tbody>
<tr>
<td>2008</td>
<td>29.2</td>
</tr>
<tr>
<td>2009</td>
<td>27.8</td>
</tr>
<tr>
<td>2010</td>
<td>19.4</td>
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(Source: epp.eurostat.ec.europa.eu)

i. Describe the trend of death rate caused by diabetes in males from 2008 to 2010. Give ONE possible reason for the trend you describe.

ii. Calculate the average death rate caused by diabetes in males during the years 2008-2010.

Total: 15 marks

4. Compare and contrast each of the following:
   a. salivary amylase and pancreatic amylase
   b. thyroid gland and adrenal glands
   c. stigma and style
   d. palisade mesophyll cell and root hair cell
   e. tapeworm and earthworm.

Total: 15 marks

5a. Plant nurseries often use techniques of tissue culture to produce plants. This method of propagating plants is known as micropropagation.

i. Give ONE reason why micropropagation techniques are used in plant nurseries.

ii. Micopropagation requires sterile lab facilities. Explain.

iii. Nurseries often grow ornamental plants in greenhouses (or glasshouses). Describe ONE benefit of this.

Total: 15 marks

b. Plant species that are at risk of extinction such as the Madagascar Periwinkle have been often micopropagated.

i. Describe ONE human activity that can lead to extinction of plants such as the Madagascar Periwinkle.

ii. Madagascar has more than 300 species of frogs. Describe TWO structural adaptations of frogs.

Total: 15 marks

c. The Madagascar Botanical Gardens initiated the campaign Adopt a Seed – Save a species.

i. Cotyledons or seed leaves in the broad bean fill most of the seed. Explain.

ii. Many annual plants produce great quantities of smaller seeds. Explain the benefit of this.

Total: 15 marks