# Biology – Form V

**TIME: 2 HOURS**

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<th>Question No.</th>
<th>Section A</th>
<th>Section B</th>
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<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Max mark</td>
<td>5 6 7 11 9 9 8</td>
<td>15 15 15 15 15</td>
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<td>Actual mark</td>
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**TOTAL MARK**

<table>
<thead>
<tr>
<th>85% Theory Paper</th>
<th>15% Practical</th>
<th>100% Final Score</th>
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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.
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.

   ![Diagram of Adjustable gastric banding]

   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, 2 marks)

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.

![Diagram of brain injuries]

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.

```
Jake         Clare
     □         □
    □         □
Steve        Noel
     □         □
    □         □
Ruth         Vince
```

Key:  □       □       □       □
      Normal male  Affected male  Normal female  Affected female

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 of coleoptile with lanolin and auxin mixture](image)

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 question 1 and any TWO others. Answer the questions of Section B on a foolscap.

1. Read the following text and answer the questions that follow.

EU bans three insecticides harmful to bees

Bee numbers have declined drastically in Europe in recent years due to a mysterious plague called colony collapse disorder. 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 namely imidacloprid, clothianidin and thiamethoxam. These insecticides are used to treat seeds and are applied to the soil or sprayed on bee-attractive plants.


a. i. Define the term population.
   ii. List TWO other factors that can lead to the decline of the bee population besides pesticides. (1, 2 marks)

b. Distinguish between persistent and biodegradable pesticides. (2 marks)

c. Pesticides in soil hinder the process of nitrogen fixation.
   i. Describe the change taking place during the nitrogen fixation process.
   ii. Pesticides bind strongly to soils that are high in clay but not as strongly to sandy soil. Compare the leaching of pesticides in clay and sandy soils. (1, 1 mark)

d. Explain why a decline in the bee population affects farmers. (2 marks)

e. A recent research study indicates that tadpoles from ponds with pesticide present in the water, take longer to metamorphose into frogs. In addition they develop into smaller frogs. Describe ONE disadvantage of this. (1 mark)

f. A researcher discovered the presence of the pesticide in the food of bald eagles. As a result the bald eagles find difficulty to absorb calcium and the lack of calcium makes the shells of the bald eagles’ eggs thinner. Explain the effect of this on the population of bald eagles. (1 mark)

g. Research studies indicate that pesticide exposure increases the risk of cancers particularly leukaemia. Leukaemia is characterised by damage to the bone marrow that results in red blood cell deficiency and lack of blood platelets. Describe TWO consequences of the damage to the bone marrow in leukaemia patients. (2 marks)

h. A recent study indicates that the use of pesticides may temporarily control the pest however in the long term the population of the pest rebounds to equal or greater numbers than it had before the pesticide use. Explain. (2 marks)

Total: 15 marks
2. The Joshua tree is one of the most characteristic plants in the Mohave desert in California. The Joshua tree is a monocotyledonous plant.

a. Compare TWO structural features of monocots and dicots. (2 marks)

b. The jackrabbit is a herbivorous mammal typically found in the Mohave desert. A biology teacher presented the following poster of the jackrabbit.

![EARS ARE NOT JUST FOR HEARING!](image)

Give a biological explanation for the message in this poster. (2 marks)

c. 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, insects and ground squirrels feed on seed.

Use the information in the description above to build a food web representing the different feeding relationships. (5 marks)

d. Desert animals are well adapted to avoid heat. Describe TWO behavioural adaptations of desert animals to avoid heat. (2 marks)

e. Most desert animals have a slower breathing rate (fewer breaths per minute). Explain ONE advantage of this adaptation. (1 mark)

f. Both birds and mammals living in deserts have oils on the surface of their skin. Explain ONE advantage of this adaptation. (1 mark)

g. Desert animals have less fat than their non-desert counterparts. Explain. (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. The infection cycle begins in spring when suitable temperatures and moisture promote the release of spores. When spores germinate, a fungal mycelium forms between the cuticle and underlying epidermal tissue.

i. Define the term *mycelium*.

ii. Name the location where spores can be found in a fungus. (1, 1 mark)

b. Describe the function of the leaf cuticle. (1 mark)

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

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

i. Name the gland that is malfunctioning in a diabetic person.

ii. Explain how the level of glucose is maintained at normal levels in a non-diabetic person.

iii. Glucose is present in the urine of a diabetic person but not present in the urine of a non-diabetic. Explain why glucose is not present in a urine sample of a non-diabetic person. (1, 4, 2 marks)

e. The following table shows the death rate caused by diabetes in males and females in Malta from 2008 to 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>Death rate in Males (by 100,000 inhabitants)</th>
<th>Death rate in Females (by 100,000 inhabitants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>29.2</td>
<td>25.5</td>
</tr>
<tr>
<td>2009</td>
<td>27.8</td>
<td>21.5</td>
</tr>
<tr>
<td>2010</td>
<td>19.4</td>
<td>14.9</td>
</tr>
</tbody>
</table>

(Source: epp.eurostat.ec.europa.eu)

List TWO conclusions that can be drawn from the data provided in the table above. (2 marks)

**Total: 15 marks**

4. Compare and contrast each of the following:

a. nitrifying and denitrifying bacteria (3 marks)

b. trypsin and pepsin (3 marks)

c. stamen and carpel (3 marks)

d. palisade mesophyll cell and root hair cell (3 marks)

e. jellyfish and garden snail. (3 marks)

**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 TWO reasons 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 TWO benefits of this. (2, 1, 2 marks)

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

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

ii. The Nile Crocodile is found in freshwater habitats in Madagascar. It is also in danger of extinction. Describe ONE human activity that led to decreased numbers of this type of crocodile in Madagascar.

iii. Madagascar has more than 300 species of frogs. Describe TWO structural adaptations of frogs. (2, 1, 2 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. Angiosperms have enclosed seeds. Explain.

iii. Many annual plants produce great quantities of smaller seeds. Explain the benefit of this. (2, 1, 1 mark)

d. Myrmecochory is the dispersal of seeds by ants. Foraging ants disperse seeds that have fleshy structures called elaiosomes attached to them. Elaiosomes are rich in lipids and other nutrients. Name this type of symbiotic relationship between the ants and the plant. (1 mark)

Total: 15 marks