

# JUNIOR LYCEUM ANNUAL EXAMINATIONS 2011

Directorate for Quality and Standards in Education  
Educational Assessment Unit

BIOLOGY – FORM V  
TIME: 2 HOURS

NAME: \_\_\_\_\_ CLASS: \_\_\_\_\_

| Question No. | Section A |   |   |    |    |    |   | Section B |    |    |    |    |            |
|--------------|-----------|---|---|----|----|----|---|-----------|----|----|----|----|------------|
|              | 1         | 2 | 3 | 4  | 5  | 6  | 7 | 1         | 2  | 3  | 4  | 5  |            |
| Max mark     | 5         | 6 | 5 | 10 | 11 | 11 | 7 | 15        | 15 | 15 | 15 | 15 |            |
| Actual mark  |           |   |   |    |    |    |   |           |    |    |    |    | TOTAL MARK |

| 85% Theory Paper | 15% Practical | 100% Final Score |
|------------------|---------------|------------------|
|                  |               |                  |

**Section A****Answer all questions in this section.**

1. Write the number of:

- a. chromosomes in a human skin cell \_\_\_\_\_
- b. the pH necessary for the action of pepsin \_\_\_\_\_
- c. the percentage concentration of oxygen in inspired air \_\_\_\_\_
- d. daughter cells produced by meiosis \_\_\_\_\_
- e. classes in the phylum Arthropoda. \_\_\_\_\_

(1, 1, 1, 1, 1 mark)

**Total: 5 marks**

2. The platypus is a semi-aquatic mammal endemic to Eastern Australia. The body and the broad tail of the platypus are covered with dense brown fur. The platypus is a carnivore that feeds on annelid worms, insect larvae and freshwater shrimps. Natural predators of the platypus include snakes, water rats, hawks, owls and eagles. Low platypus numbers in Northern Australia are possibly due to predation by crocodiles.



a. From the passage above list:

- i. ONE reptile \_\_\_\_\_

- ii. ONE crustacean \_\_\_\_\_

- iii. ONE biotic factor that affects the population size of the species. \_\_\_\_\_

(1, 1, 1 mark)

- b. Mammals are endothermic vertebrates. List ONE other class of endothermic vertebrates.

\_\_\_\_\_ (1 mark)

- c. Explain the benefit of having a body covered with dense fur.

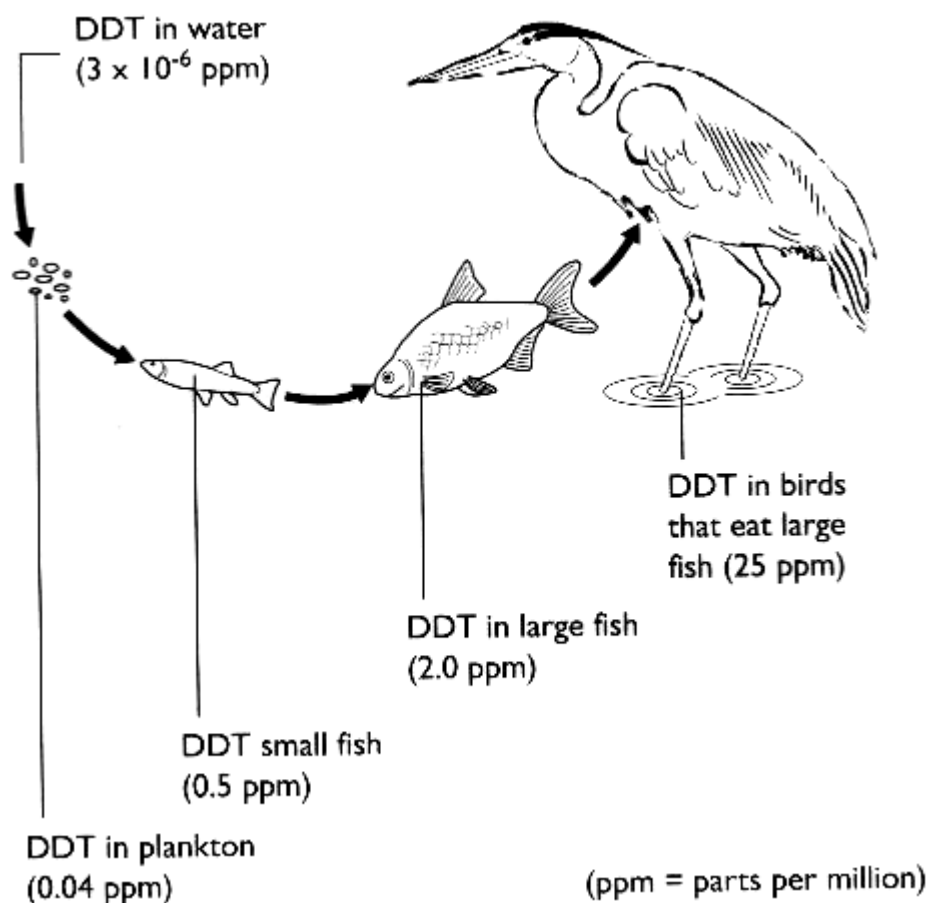
\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

- d. Define the term carnivore.

\_\_\_\_\_ (1 mark)

**Total: 6 marks**

3. Some time after DDT was introduced as a pesticide, people noticed that the number of fish-eating birds like herons was falling. The tissues of these birds were analysed and found to contain amounts of DDT. The DDT made the birds produce eggs that had very thin shells that broke easily and killed the chicks inside. The following diagram shows the levels of DDT along the organisms in a food chain.



- a. With reference to the food chain shown in the diagram above to which trophic level do the fish-eating birds like the heron belong?

\_\_\_\_\_ (1 mark)

- b. Explain how the levels of DDT increase at each level of the food chain.

\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

- c. List TWO alternative ways of pest control that limit the effects of pesticides such as the DDT.

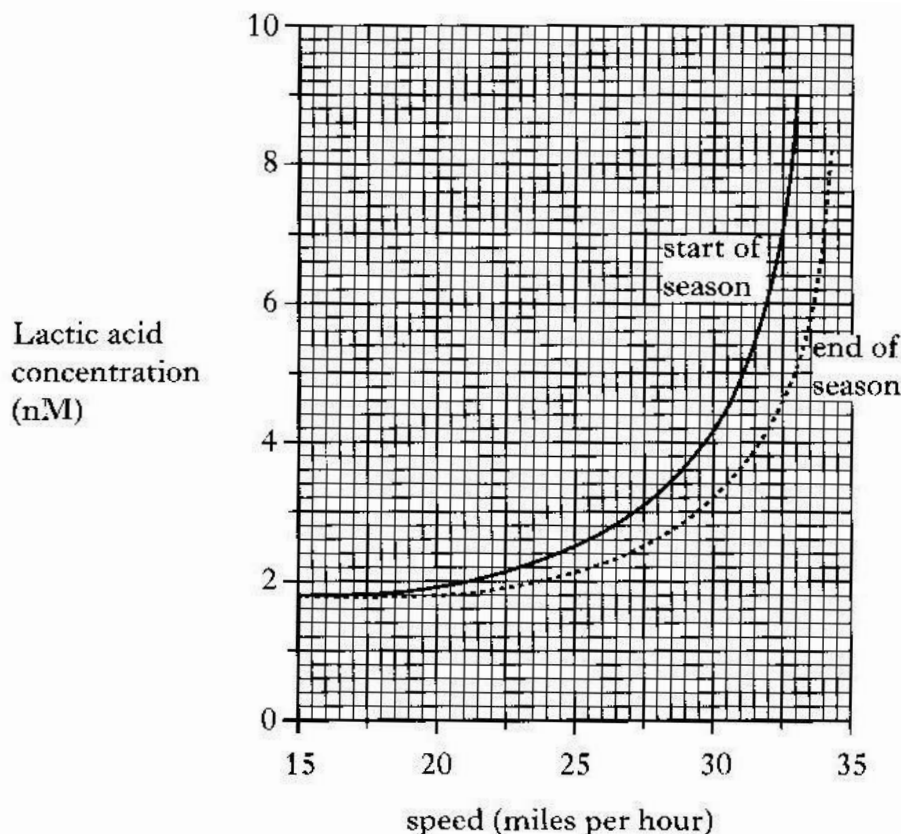
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

**Total: 5 marks**

4. The following table shows a comparison of the breakdown of 1g of glucose by the types (A, B and C) of cell respiration.

|                             | Type of cell respiration |     |      |
|-----------------------------|--------------------------|-----|------|
|                             | A                        | B   | C    |
| Energy released (kJ)        | 17.1                     | 0.9 | 0.9  |
| Oxygen used (g)             | 1.07                     | 0   | 0    |
| Carbon dioxide produced (g) | 1.47                     | 0   | 0.49 |
| Water produced (g)          | 0.6                      | 0   | 0    |
| Lactic acid produced (g)    | 0                        | 1   | 0    |
| Ethanol produced (g)        | 0                        | 0   | 0.51 |

- a. Write the letter of the type of respiration that takes place in:
- yeast cells \_\_\_\_\_ (1, 1 mark)
  - muscle cells (after heavy exercise) \_\_\_\_\_ (1, 1 mark)
- b. Write the chemical equation for the type of respiration taking place in A. \_\_\_\_\_ (2 marks)
- c. The following graph shows the lactic acid content of the blood of a professional cyclist that was measured at different speeds. These measurements were taken at the start of the racing season and at the end.



- i. Compare the lactic acid concentration in the blood of the cyclist at the start of the season and at the end of the season.

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- ii. What was the speed of the cyclist at the start of the season when he was producing 50% of the maximum lactic acid concentration?

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(2, 1 mark)

- d. During exercise the heart pumps more blood per minute. Explain the importance of this.

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(1 mark)

- e. What is the *oxygen debt*?

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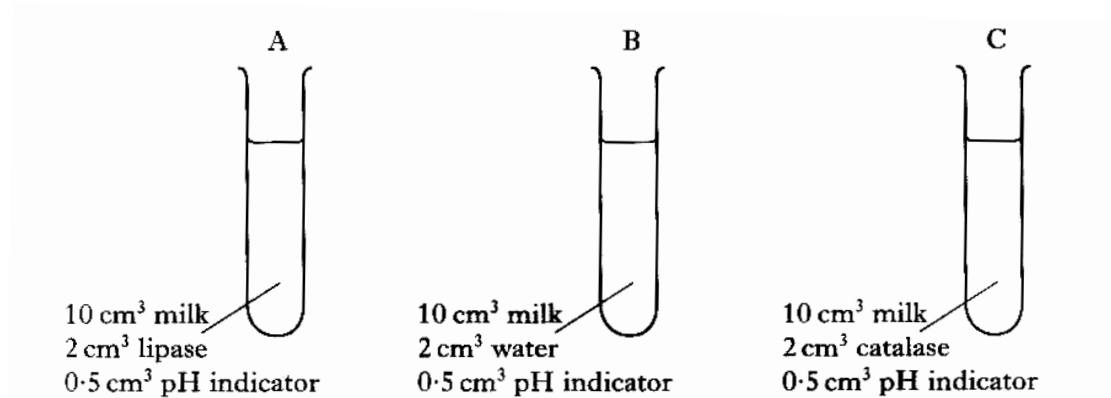


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(2 marks)

**Total: 10 marks**

5. A group of biology students investigated the activity of the enzymes lipase and catalase. Three test tubes were set up as shown in the diagram below. The colour of the pH indicator was noted at the start of the investigation and after 20 minutes. The results obtained are shown in the table below.



| Test tube | Colour of pH indicator    |                  |
|-----------|---------------------------|------------------|
|           | At start of investigation | After 20 minutes |
| A         | green                     | orange           |
| B         | green                     | green            |
| C         | green                     | green            |

- a. In the investigation the students used the same quantity of milk.
- i. List TWO other conditions related to milk that need to be kept the same during this investigation.

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- ii. Write the letter of the test tube that acts as the control.

(2, 1 mark)

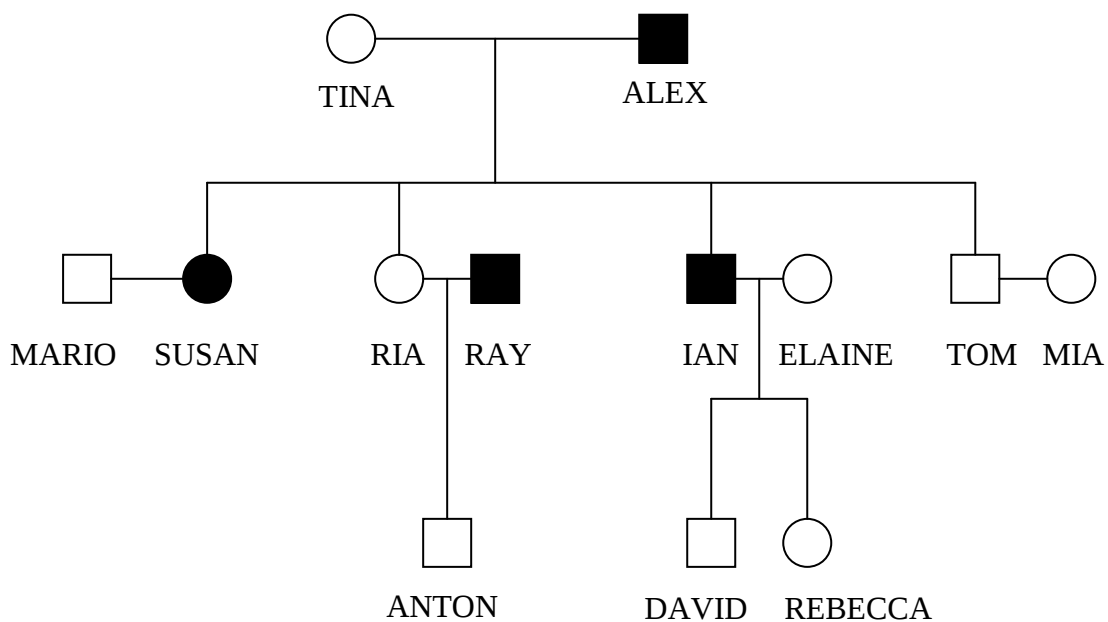
- b. In tube A, the pH indicator colour change was due to the production of fatty acids as the lipase reacted with the fat in the milk. Explain why there was no change in tube C.

(1 mark)

- c. Lactose is the disaccharide sugar component of milk.  
Write the TWO monomers making up the disaccharide lactose.

(1 mark)

- d. Lactose intolerance is the inability to metabolise lactose because of the required enzyme lactase. Congenital Lactase deficiency (CLD) is inherited as an autosomal recessive trait (represented as **t**). This results in a marked deficiency of lactase production if any at all in the small intestine from birth.



Key:



Normal male



Normal female



Affected male



Affected female

- i. Define the term *recessive*.

ii. Write Tina's genotype for CLD.

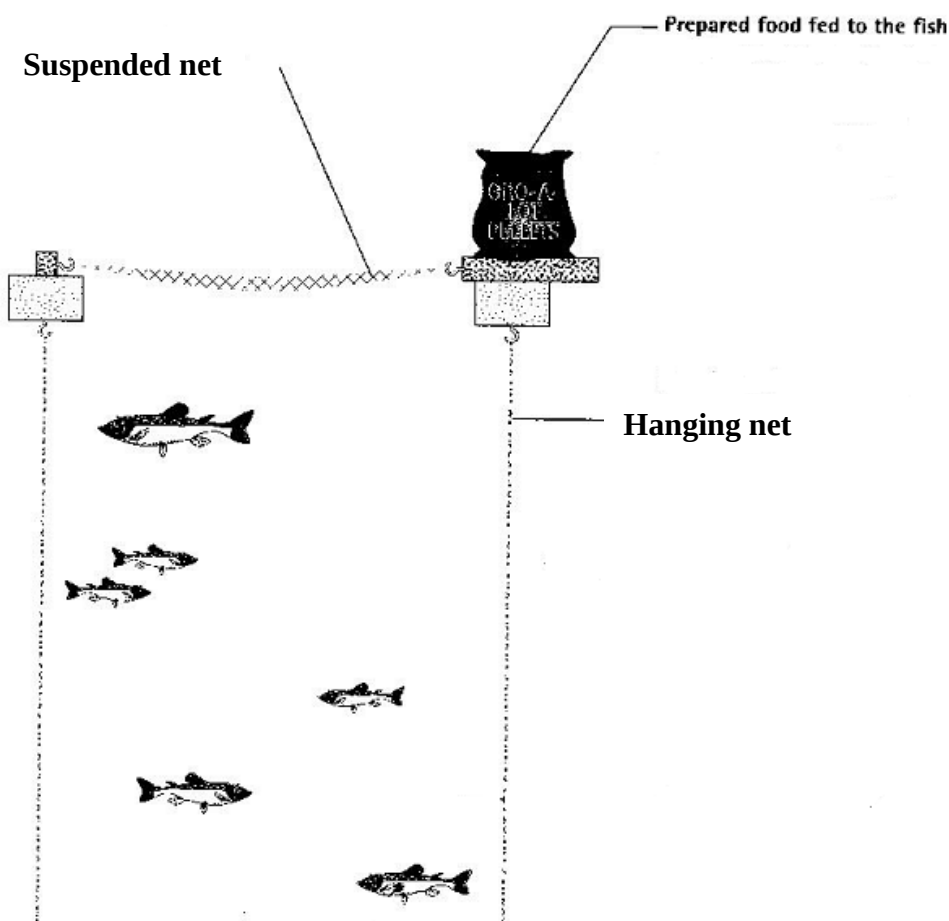
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iii. Tom and Mia are both unaffected however they still have the possibility of having a child suffering from the lactose intolerance deficiency. Use genetic diagrams to work out the percentage chance of having an affected child.

(1, 1, 4 marks)

**Total: 11 marks**

6. Fish farming involves raising fish commercially in tanks or enclosures usually for food.



a. Explain why:

i. in fish farms there are suspended nets

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ii. in fish farms there are hanging nets

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iii. more pesticides are added to water in fish farm tanks/enclosures

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iv. some fish farmers put air bubblers in the fish tanks/enclosures.

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(1, 1, 1, 3 marks)

b. Salmon are commonly grown in fish farms. In their natural environment salmon lay their eggs in freshwater rivers. Young salmon migrate to the sea where they stay until they mature.

i. Explain why salmon need to drink water when they are in sea water.

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ii. Compare the urine output of salmon living in sea water with that of salmon living in freshwater.

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(2, 2 marks)

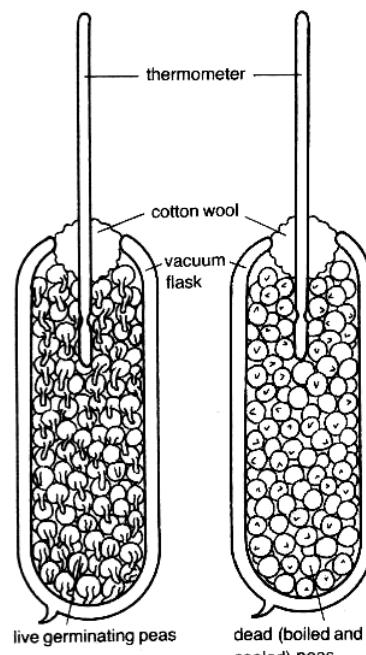
c. Salmon is a popular healthy food. Give ONE benefit of including fish in the diet.

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(1 mark)

**Total: 11 marks**

7. A biology teacher set up the following apparatus.



- a. Describe the result you would expect after the apparatus had been set up for a few days. Give a reason for your answer.

**Result:** \_\_\_\_\_

**Reason:** \_\_\_\_\_

(3 marks)

- b. The pea leaf weevil *Sitona lineatus* is an insect that damages pea plants and other legumes. The weevil larvae feed on the root nodules of the pea plants. How does this affect the pea plant?

(2 marks)

- c. Peas show hypogeal germination. Explain the term hypogeal germination.

(2 marks)

**Total: 7 marks**

## Section B

**Answer question 1 from this section and choose TWO other questions. Answer the questions of section B on a foolscap.**

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

The Atkins Diet is a low-carbohydrate diet created by Robert Atkins. Atkins said that unrecognized factors in Western eating habits lead to obesity. Primarily he believed that the main cause of obesity is eating refined carbohydrates particularly sugar, flour and high-fructose corn syrup. The Atkins Diet involves restriction of carbohydrates to switch more frequently the body's metabolism from burning glucose as fuel to burning stored body fat. This process, called ketosis, begins when insulin levels are low.

- a. From the passage above list:
- ONE monosaccharide
  - ONE hormone.
- (1, 1 mark)
- b. Describe what happens if the blood glucose levels fall drastically. (3 marks)
- c. A high protein diet like the Atkins Diet can cause kidney stones. Kidney stones may form in the ureter. Give ONE possible effect of kidney stone formation in the ureter. (1 mark)
- d. Describe the structure of a fat molecule. (1 mark)
- e. The chemical reactions occurring inside the cells are called metabolism. Explain why these chemical reactions are affected by temperature. (3 marks)

f. Obesity strains the heart. An obese person has more body fat which means more molecules such as cholesterol are present in the blood vessels. Explain how this causes strain on the heart. (3 marks)

g. A recent study revealed that Maltese children aged between seven and eleven were considered to be the most obese and overweight in the European Union. List TWO possible reasons for this. (2 marks)

**Total: 15 marks**

2. The rainforests are home to more species or populations than all other biomes added together.

a. Define the terms species and population. (2 marks)

b. Rainforests are characterised by high rainfall. This often results in poor soils. Explain. (1 mark)

c. The area covered by rainforests around the world is rapidly shrinking. List TWO reasons for this. (2 marks)

d. The term epiphyte describes a plant that like a parasite grows on a host, but unlike a parasite takes no nutrients from the tree itself and relies on nutrients from the air, falling rain and the compost that lies on tree branches.

i. List TWO advantages of plants adopting an epiphytic mode of life.

ii. Common epiphyte plants in the tropics are ferns. Ferns are vascular plants. Explain.

(2, 2 marks)

e. A rich variety of insects including beetles, stick insects, mites, ticks and mosquitoes use the forest canopy as a habitat. Mosquitoes go through four stages in their life-cycle. The dragonfly nymph eats mosquitoes at all stages of development.

i. Name the FOUR stages in the life-cycle of the mosquito.

ii. Name the type of metamorphosis that a dragonfly undergoes.

(2, 1 mark)

f. Explain how

i. high temperature and

ii. low humidity

increase the rate of transpiration.

(1, 2 marks)

**Total: 15 marks**

3. IVF (in vitro fertilisation) is a process by which egg cells are fertilised by sperm outside the uterus. IVF may be used to overcome female infertility due to problems of the fallopian tube. It may also assist in male infertility where there is defect sperm quality. The process involves hormonally controlling the ovulatory process, removing ova from the female's ovaries and letting sperm fertilise them in a fluid medium. The fertilised egg is then transferred to the female's uterus with the intent to establish a successful pregnancy.

a. Write the correct term that describes the:

i. fertilised egg

ii. cell division that produces sperms

iii. the lower end of the uterus.

(1, 1, 1 mark)

b. The female ovaries are endocrine glands. Explain.

(2 marks)

- c. Give the difference in the chromosome number between the egg released from the ovary and the fertilised egg.
- d. In the laboratory semen is prepared for IVF by removing inactive cells and seminal fluid in a process called sperm washing.
  - i. Explain the importance of seminal fluid in semen.
  - ii. Semen can be the vehicle for many sexually transmitted diseases including genital herpes and HIV. List TWO ways of preventing the spread of sexually transmitted diseases. (1, 2 marks)
- e. Explain the importance of the mitochondria present in the middle piece of sperm cells. (1 mark)
- f. At the end of the gestation period the uterus begins to undergo occasional contractions which become steadily more frequent and powerful. This is called labour. List TWO other important changes that take place in the female body during this stage. (2 marks)
- g. In fish external fertilisation takes place. List TWO disadvantages of external fertilisation. (2 marks)

**Total: 15 marks**

- 4. Give a biological explanation for **each** of the following statements:
  - a. Leaves have pores.
  - b. If you put your hand on a hot plate, you pull it away quickly.
  - c. Bad farming methods can lead to soil erosion.
  - d. The liver deaminates amino acids.
  - e. Vegetative reproduction is advantageous to the gardener. (3, 4, 3, 2, 3 marks)

**Total: 15 marks**

- 5a. List THREE ways in which the human body loses water. (3 marks)
- b. Explain why the presence of blood cells or protein in a person's urine is a sign of kidney damage. (2 marks)
- c. List TWO differences in the composition of blood present in the renal artery with that present in the renal vein. (2 marks)
- d. Why are the lungs organs of excretion? (2 marks)
- e. The kangaroo rat lives in arid (dry) areas of Mexico. The kangaroo rat has a longer loop of Henle` in the nephrons.
  - i. What is the main function of the loop of Henle`?
  - ii. What is the advantage of a longer loop of Henle` to the kangaroo rat?
  - iii. Kangaroo rats do not have sweat glands. What is the benefit of this?
  - iv. Kangaroo rats have powerful hind legs. List TWO advantages of this.

(1, 2, 1, 2 marks)

**Total: 15 marks**