

MARKER CODE				



Student Enrolment Number									

TONGA FORM SIX CERTIFICATES

2016

BIOLOGY

QUESTION AND ANSWER BOOKLET

Time allowed: 2 Hours & 15minutes

INSTRUCTIONS

1. Write your **Student Enrolment Number (SEN)** on the top right-hand corner of this page.
2. Additional sheets of paper can be obtained from your supervisor if necessary. Write your **Student Enrolment Number (SEN)** on each addition sheet number the questions clearly and insert them in the appropriate part of your booklet and tie securely.
3. You are expected to apply the principles and knowledge learned from the Biology curriculum taught throughout this academic year.
4. This examination consists of **THREE** Sections.

SECTION		Pages	Total Skill Level	Time
A	Multiple Choice	2-6	10	30 minutes
B	Short Answer	7-24	50	65 minutes
C	Extended Response Questions	25-29	15	40 minutes
		29	75	135 minutes

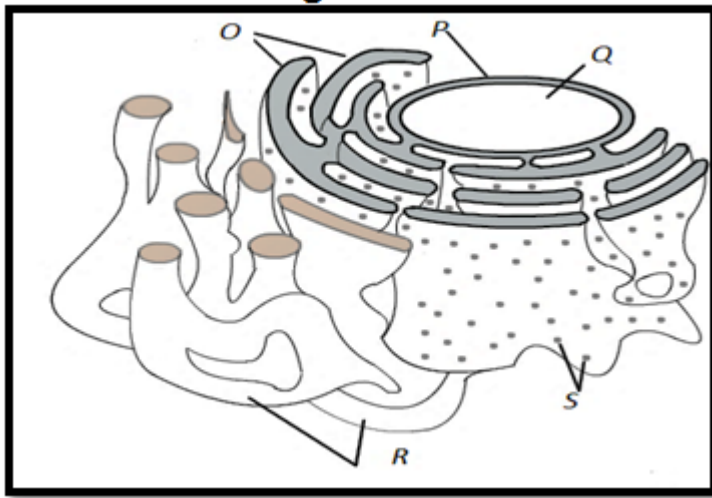
5. Check that this booklet contains pages 2-31 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR BEFORE YOU LEAVE THE EXAMINATION ROOM.

SECTION A**MULTIPLE CHOICE**

Circle the letter of the **BEST** answer

1. The diagram below illustrates part of a prokaryotic cell.



Which of the following labels correctly match structures **O, P, Q, R** and **S**?

	O	P	Q	R	S
A	Endoplasmic Reticulum	Cell Membrane	Large Vacuole	Transport tube	Starch Molecules
B	Endoplasmic Reticulum	Cell Membrane	Nucleus	Transport tube	Ribosomes
C	Rough ER	Nuclear Membrane	Large Vacuoles	Smooth ER	Starch Molecules
D	Rough ER	Nuclear membrane	Nucleus	Smooth ER	Ribosomes

Skill level 1	
1	
0	
NR	

2. The substances i. – iii. below play a key role in the process of photosynthesis:

- i. Carbon dioxide and water
- ii. Light and chlorophyll
- iii. Glucose and oxygen

Which equation best represents the process of photosynthesis?

- A. 1 $\longrightarrow$ 2 in the presence of 3
- B. 1 $\longrightarrow$ 3 in the presence of 2
- C. 2 $\longrightarrow$ 3 in the presence of 1
- D. 3 $\longrightarrow$ 1 in the presence of 2

Skill level 1	
1	
0	
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3. The table below shows the number of animals collected from some woodland and the Taxonomic Groups to which they belong:

Animal Group	Number in a sample
Annelids	8
Arachnids	10
Insects	80
Mollusks	40
Myriapods	7
Nematodes	15

In total, how many '**Arthropods**' were collected?

- A. 33
- B. 97
- C. 120
- D. 160

Skill level 1	
1	
0	
NR	

4. Statements **i- iv describe** the characteristics of enzymes:

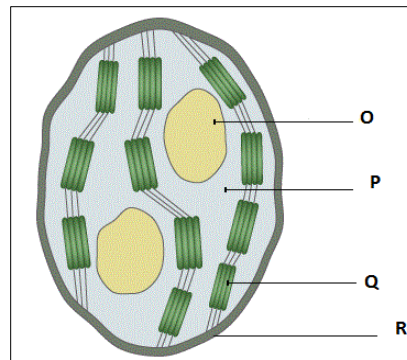
- i. *They exist as globular proteins.*
- ii. *They are found on Rough ER.*
- iii. *They fit in to specified substrates.*
- iv. *They are inhibited by competitive inhibitors.*

Which statements best describe all enzymes?

- A. 1 , 2 & 3 only
- B. 2 , 3 & 4 only
- C. 1 , 3 & 4 only
- D. 1 , 2, 3 & 4

Skill level 1	
1	
0	
NR	

5. The diagram below shows a cell organelle present only in plant cells.

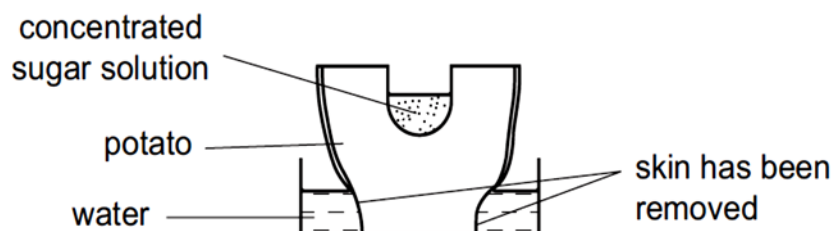


The site for ***Independent Light Reaction*** is correctly identified by which letter?

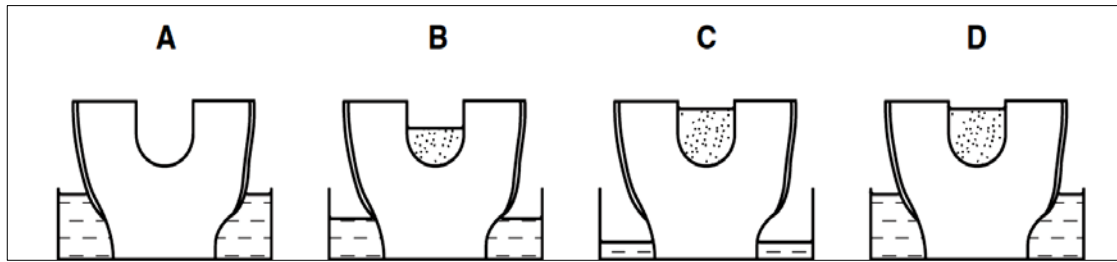
- A. O
- B. P
- C. Q
- D. R

Skill level 1	
1	
0	
NR	

6. The diagram below shows an experiment using an uncooked potato. The skin of the potato was removed. The potato was cut in the middle and filled with sugar solution as shown in the diagram below.

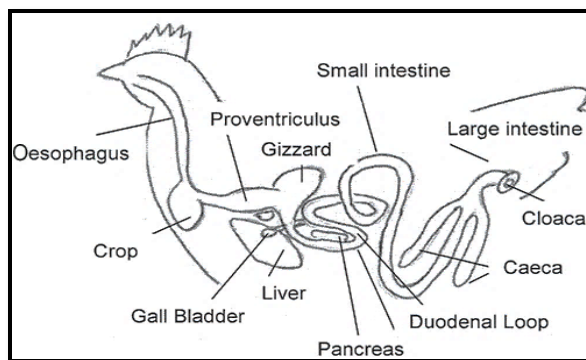


With reference to 'OSMOSIS', which diagram would demonstrate best the definition of osmosis after 24 hours?



Skill level 1	
1	
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NR	

7. The diagram below illustrates the alimentary canal of a chicken.



With the assistance of the diagram, which definition correctly matches the process?

- A. Absorption – absorb metabolic substances and digested food in the Small Intestine.
 B. Ingestion – breaking down of large molecules of food into bolus in the Esophagus.
 C. Egestion – reabsorption of water in the Cloaca
 D. Digestion – chemical breakdown of food in the Crop.

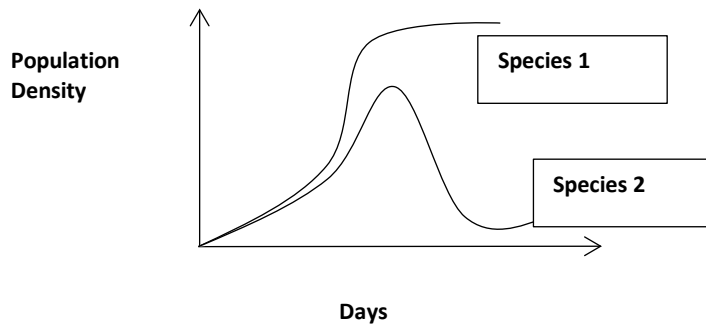
Skill level 1	
1	
0	
NR	

8. The process of '**excretion**' plays a significant role in organisms as compared to any other functional system. Why? Because of the need to _____.

- A. release ATP Energy from cells for the body to function.
 B. release water through respiration process.
 C. remove metabolic wastes in mammals for homeostasis.
 D. remove of undigested wastes stored in the human body.

Skill level 1	
1	
0	
NR	

9. The graph below shows changes in the population densities of two animal species living in the same habitat.



The interactions between the two species result in a **competitive exclusion**. What environmental principle does the graph support?

- A. Adaptation Rules
- B. Gause's Principle
- C. Ecological Niche Principle
- D. Liebig's Law of Minimum

Skill level 1	
1	
0	
NR	

10. The table below shows some 'adaptive features' of some vertebrates. Which description best matches the vertebrates.

Adaptive features				
	Feathers	Gills	Hair	Wings
A	Cool the body by evaporation	Increase SA for flying	Body Insulation	Increase surface area for gas exchange
B	Cool the body by evaporation	Increase surface area for gas exchange	Body Insulation	Increase SA for flying
C	Body Insulation	Cool the body by evaporation	Increase surface area for gas exchange	Increase surface area for gas exchange
D	Body Insulation	Increase surface area for gas exchange	Cool the body by evaporation	Increase SA for flying

Skill level 1	
1	
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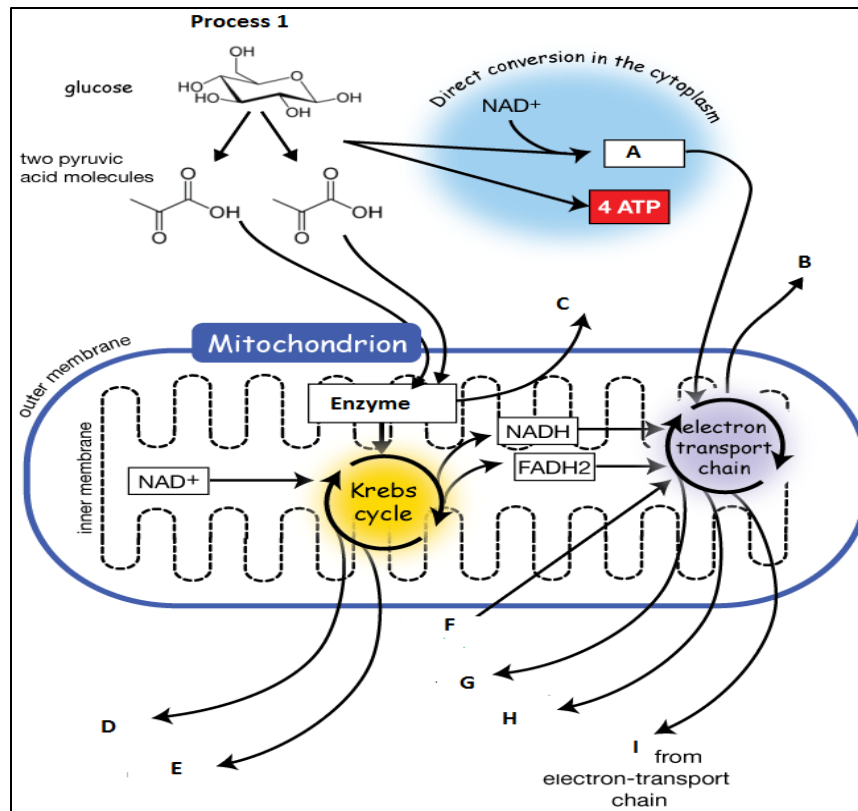
SECTION B

SHORT ANSWERS

This section consists of **FOUR** questions. Each question consists of **TEST ITEMS** under **SKILL LEVEL 2 and 3. ATTEMPT ALL** questions in the space provided.

Question 1

1. The diagram below illustrates the stages of “Cellular Respiration”.



- a. With the assistance of the diagram, briefly describe the following headings:

(Hint: include in your answer at least TWO (2) of the followings: name of the process, site of reaction, products released, reactants, amount of ATP produced)

- i. **Process 1:**

Skill level 2	
2	
1	
0	
NR	

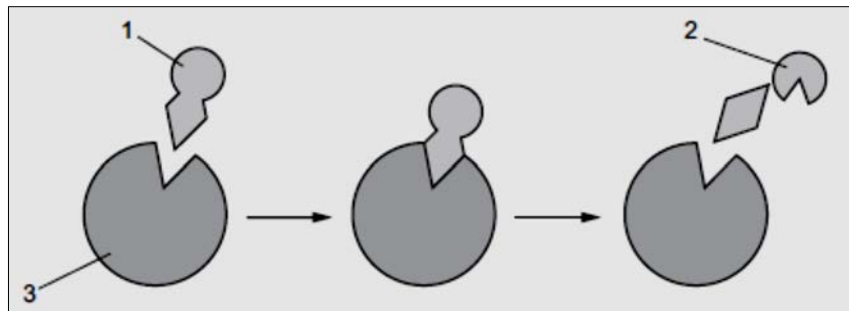
ii. **Krebs Cycle:**

Skill level 2	
2	
1	
0	
NR	

iii. **Electron Transport Chain (ETC)**

Skill level 2	
2	
1	
0	
NR	

2. The diagram below shows the Induced Fit Model of enzyme action:

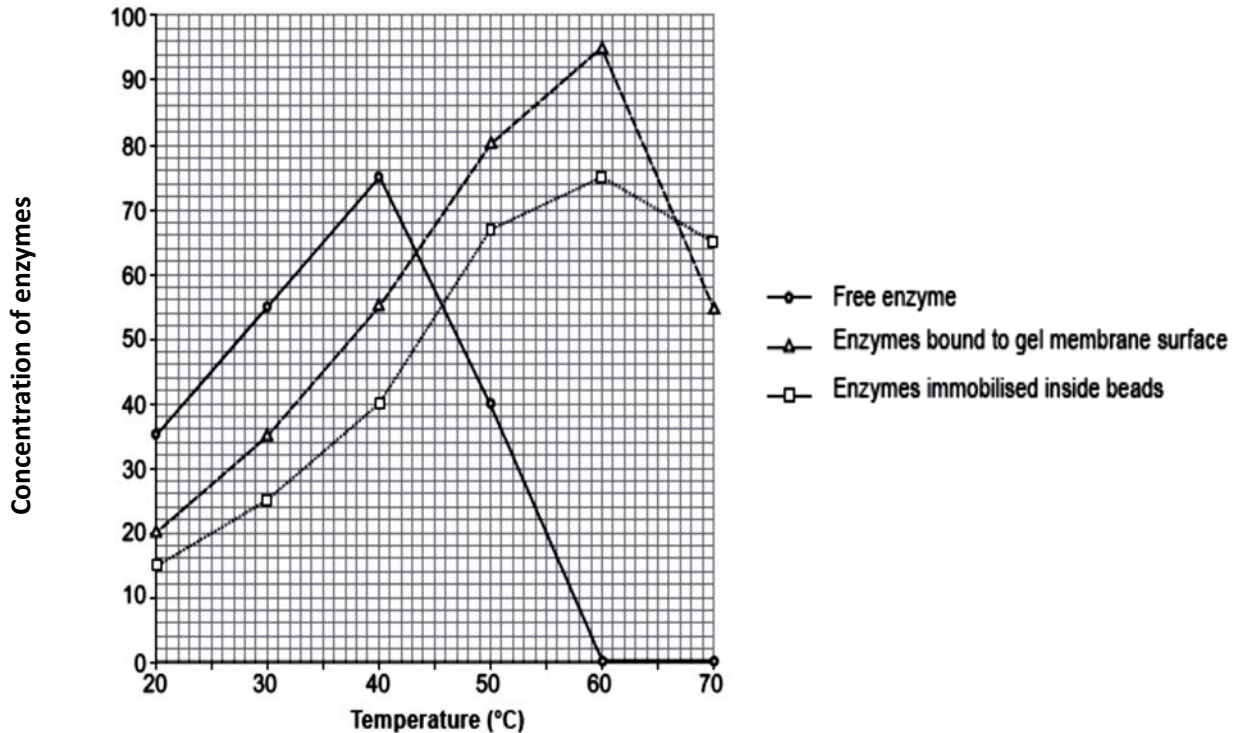


- a. Briefly explain the **model** in terms of **enzyme-substrate activity**. Include in your discussion the names for structures 1, 2, 3.

Skill level 3	
3	
2	
1	
0	
NR	

3. Three enzyme –activities were tested, compared and recorded as shown in the graph below:

Title : Comparison of enzyme activities.



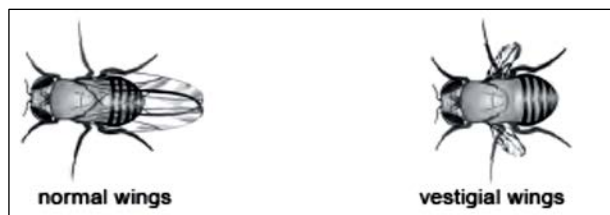
- a. Examine the graph and explain the reason for the differences seen in the results for the enzymes bound to the gel membrane surface with those immobilized inside the beads and the free-enzymes , between temperature 20 °C and 60 °C.

Skill level 3	
3	
2	
1	
0	
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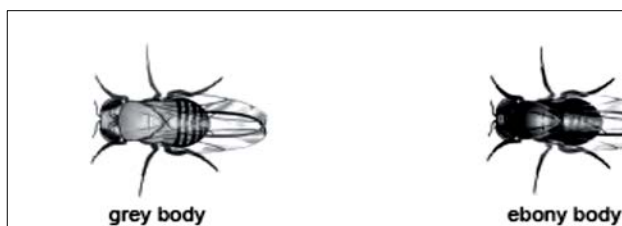
Question 2

1. The fruit fly *Drosophila melanogaster* is extensively used to study genetics because it is relatively easy to cause mutations in these fruit flies.

- ☐ Some mutant fruit flies have very small (vestigial) wings.



- ☐ Other mutant fruit flies have dark (ebony) bodies instead of the normal grey body.



In a di-hybrid cross, when fruit flies with normal wings and grey bodies were crossed with fruit flies with vestigial wings and ebony bodies all the offspring had normal wings and grey bodies.

- a. The F_1 hybrid fruit flies (*heterozygous for both traits*) were allowed to interbreed freely. The F_2 fruit flies were sorted and counted. The results are shown below.

Phenotype		Number of fruit flies
Wings	Body	
Normal (N)	Grey (G)	75
Normal	Ebony (g)	23
Vestigial (n)	Grey	21
Vestigial	Ebony	9

With the assistance of the information below, complete the blank boxes in punnet square to show the expected F₂ offspring.

(Do not Complete the shaded boxes)

F1 Phenotypes Normal wing, grey body X Normal wing grey body

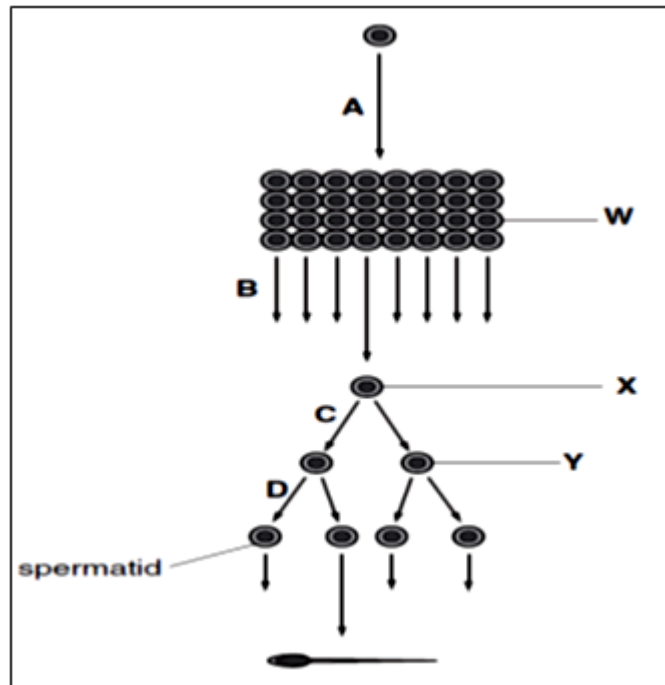
F1 Genotypes Nn Gg X Nn Gg

Gametes NG , Ng , nG, ng (Use the order stated below)

X	NG	Ng	nG	ng

Skill level 2	
2	
1	
0	
NR	

3. The diagram below shows the stages in a spermatogenesis the production of male sex cell in an animal.



- a. Describe the sequence of events occurring **in A, B and C**. Include in your answer the number of daughter cells, number of chromosomes in the daughter cells and comparisons of number to parent cell.

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Skill level 3	
3	
2	
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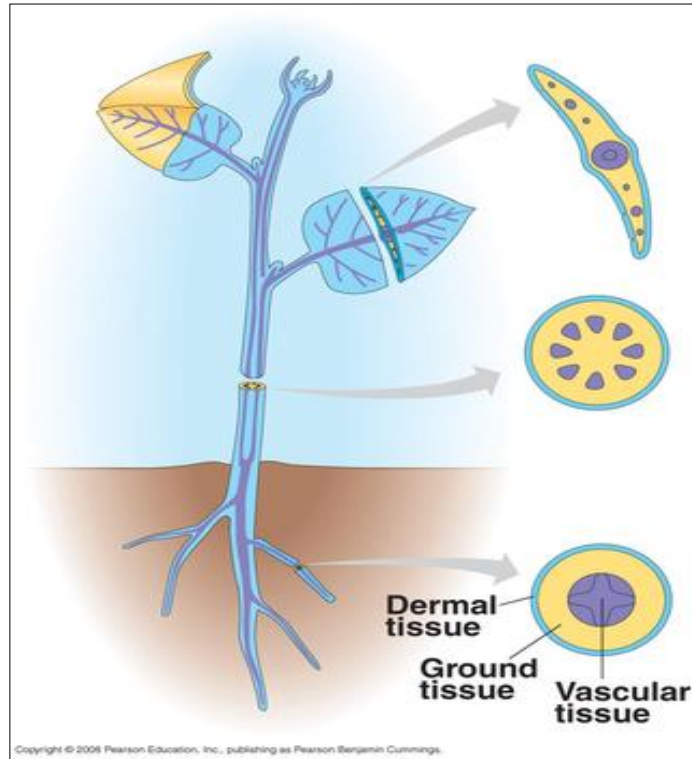
- b. Briefly explain the *significance event* labelled ‘**D**’ that determines ‘*variation*’ caused by structure ‘**E**’.

[illegible]

	Skill level 3	
	3	
	2	
	1	
	0	
	NR	

Question 3

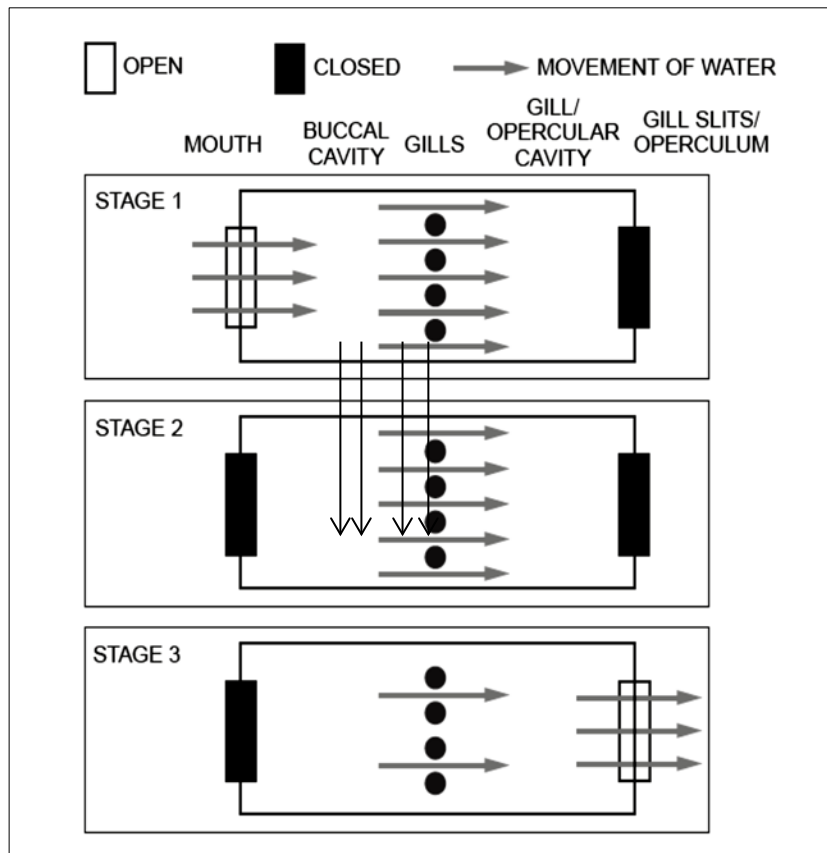
1. The diagram below illustrates the three main connective tissues found in meristem cells of plants.



- a. Out of the three tissues labelled in the diagram, ***vascular tissues*** are special. Suggest reasons why in terms of its structure and role in plants.

Skill level 2	
2	
1	
0	
NR	

2. The system of ventilation in a bony fish enables water to be passed continuously over the gills whilst the fish is at rest. The diagram below shows three stages of the process of ventilation and gas exchange in fish.



- a. Examine the **THREE** (3) stages in details and answer the followings questions.

- i. Describe the process of *ventilation* occurring in *stages 1 and 2*.

Skill level 2	
2	
1	
0	
NR	

Skill level 3	
3	
2	
1	
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-
- A diagram of the hepatic portal system. The liver is at the top. Below it, the hepatic portal vein is shown as a central vessel with arrows indicating blood flow upwards into the liver. Several tributaries join this vein: the superior mesenteric vein from the small intestine, the pancreaticoduodenal vein from the pancreas, and the splenic vein from the spleen. The inferior mesenteric vein from the colon also joins the system. Labels with leader lines identify the liver, hepatic portal vein, pancreas, spleen, colon, and small intestine.

- b. Blood in the hepatic portal vein is deoxygenated. Describe why the **'blood'** in the hepatic portal vein is deoxygenated rather than being oxygenated?

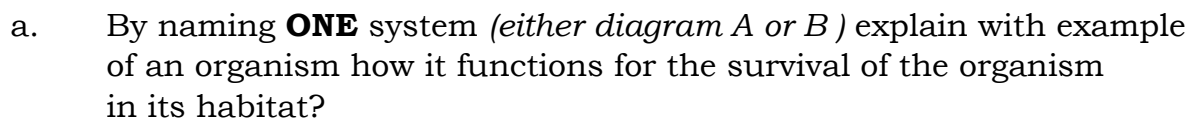
[illegible]

Skill level 2	
2	
1	
0	
NR	

- b. One of the liver's function is to maintain blood sugar level. Using information from the diagram only, explain the role of the Liver IF the sugar level is LOW.

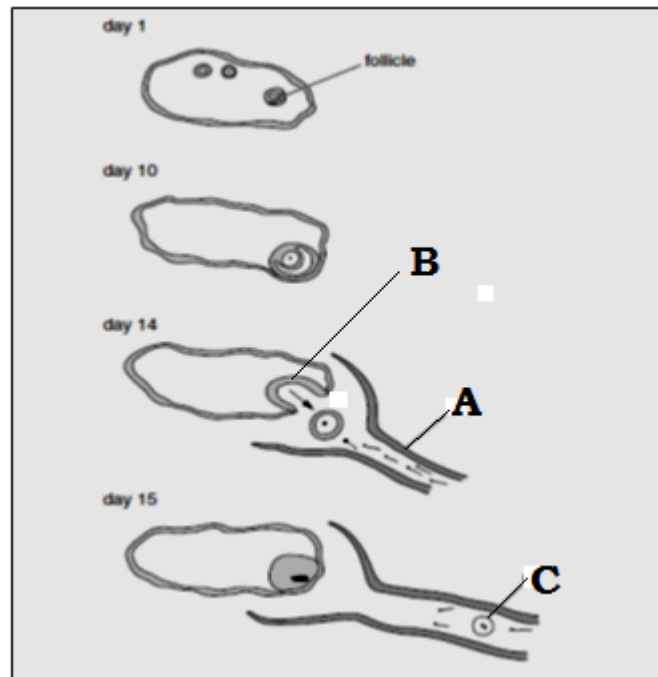
[illegible]

Skill level 3	
3	
2	
1	
0	
NR	

[illegible]

Skill level 2	
3	
2	
1	
0	
NR	

6. The diagram below illustrates the changes in a human ovary during the first part of the menstrual cycle and after the fertilization of an egg.



- a. Describe the possible events occurring at day 14, day 15 and that after day 15 that may lead to development of the embryo. Include in your answer, names of **A**, **B** & **C**.

[illegible]

Skill level 3	
3	
2	
1	
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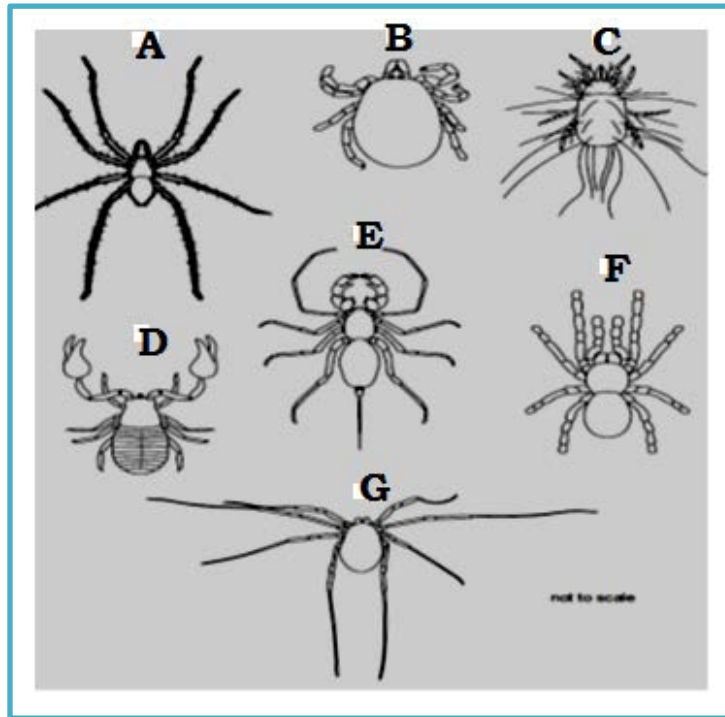
- b. Explain the effects of estrogen and progesterone hormones on day 1- day 15 and after.

[illegible]

Skill level 2	
2	
1	
0	
NR	

Question 4

1. The diagram below shows seven unknown species of **Arachnid**.



1.a	Abdomen with a tail	<i>Abelielia dicranotarsis</i>
1.b	Abdomen without a tail	Go to 2
2.a	Legs much longer than abdomen and celathorax	Go to 3
2.b	Legs not longer than abdomen and celathorax	Go to 4
3.a	Hairs on the legs	<i>Tegenaria domestica</i>
3.b	No hairs on the legs	<i>Odielus spinosus</i>
4.a	Celathorax or abdomen segmented	<i>Chelifer tuberculatus</i>
4.b	Celathorax or abdomen unsegmented	Go to 5
5.a	Abdomen and celathorax are the same size	<i>Poecilotheria regalis</i>
5.b	Abdomen is larger in size than celathorax	Go to 6
6.a	Body covered with hairs	<i>Tyroglyphus longior</i>
6.b	Body not covered in hairs	<i>Ixodes hexagonus</i>

- a. Use the dichotomous key provided to identify the following species.

i. **Unknown Species B:**

ii. **Unknown Species G:**

Skill level 2	
2	
1	
0	
NR	

- b. Give the **genus name** for **organism E** and suggest a reason for your answer?

Skill level 2	
2	
1	
0	
NR	

- c. Explain how the '**adaptations of an organism**' relate to the followings concepts:

1. Gause's principle.
2. An organism's niche.
3. Liebig's law.

Skill level 3	
3	
2	
1	
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Marks will be given to answers that show clear, accurate expressions of ideas in a logical and cohesive manner. **Marking criteria is provided at the end of the questions.**

*“Anaerobic Respiration is also known as “Incomplete reaction” **OR** “Fermentation reaction”. With supported examples, write one summary definition for the terms and discuss how the process of anaerobic respiration contributes to commercial productions. Use the marking criteria to guide your answer.*

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Assessors Use Only

Summary Definition		Discussions			
1. 1 Summary Definition		2.1 Reactant & Product for the reaction if occurred in plants		2.2 Fermentation process to show the production commercial examples 1 & 2	
LEVEL 1		LEVEL 2		LEVEL 2	
1		2		2	
0		1		1	
NR		0		0	
		NR		NR	

From your knowledge of the application of genetics, define the term phenotype and explain one advantage and one disadvantage of GMO globally. Include an example of local GMO species in your discussion.

Assessors Use Only

Definition of Phenotype		Discussions			
1. 1 Definition of Phenotype		2.1 Relation to GMO Advance of GMO		2.2 Disadvantage of GMO Example of GMO	
LEVEL 1		LEVEL 2		LEVEL 2	
1		2		2	
0		1		1	
NR		0		0	
		NR		NR	

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Assessors Use Only

Metabolic waste released in daytime		Discussions (Comparison of Ferns and Angiosperms)			
1. 1 Definition of Phenotype		2.1 Sporophyte generation (definition, gametes are haploid or diploid, dependence of fertilization, dispersal methods)		2.2 Gametophyte generation (definition, gametes are haploid or diploid, dependence of fertilization, dispersal methods)	
LEVEL 1		LEVEL 2		LEVEL 2	
1		2		2	
0		1		1	
NR		0		0	
		NR		N R	