MARKER CODE				

STUDENT ENROLMENT NUMBER (SEN)									

TONGA FORM SIX CERTIFICATE

2020

BIOLOGY

QUESTION AND ANSWER BOOKLET

Time allowed: 3 Hours

INSTRUCTIONS:

1. Write your **Student Enrolment Number (SEN)** on the top right-hand corner of this page.
2. This paper consists of **FOUR QUESTIONS** and is out of 75 Weighted scores.

QUESTION	TOPICS	TOTAL SKILL LEVEL
ONE	**CELLULAR BIOLOGY**	21
TWO	**GENETICS**	10
THREE	**ORGANISM LEVEL BIOLOGY**	22
FOUR	**ENVIRONMENTAL BIOLOGY**	22
	TOTAL	**75**

3. Answer ALL QUESTIONS. Write your answers in the spaces provided in this booklet.
4. Use a **BLUE** or **BLACK** ball point pen only for writing. Use a pencil for drawing if required.
5. If you need more spaces for answers, ask the supervisor for extra paper. Write your **Student Enrolment Number (SEN)** on each additional sheet, number the questions clearly and insert them in the appropriate places in this booklet.
6. Check that this booklet contain pages 2-23 in the correct order and that pages 21-23 have been deliberately left blank.

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

QUESTION ONE: CELLULAR BIOLOGY

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QUESTION ONE: Genetics **(11 scores)**

1. In horses, coat colour is determined by two genes. The allele for black coat (**B**) is dominant to the allele for chestnut coat (**b**). The allele for grey coat (**G**) is dominant to the allele for non-grey coat (**g**).

   Horses with the allele **G** are **always** grey.
   A male with the genotype **GgBb** was crossed with a female with the genotype **ggBb**.

   (a) (i) State the *phenotype* of each parent.

   male _____

   female _____

Skill level 1	
1	
0	
NR	

   (ii) Complete the grid by adding the genotypes of:

   1 the male and female gametes;

   2 the possible offspring.

		male gametes			
female gametes					

Skill level 2	
2	
1	
0	
NR	

   (iii) Give the expected *phenotypic ratio* of the offspring from this cross.

   _____grey: _____black: _____chestnut

Skill level 1	
1	
0	
NR	

(b) A further gene determines the presence of large white markings in the coat. The allele for the presence of white markings (**T**) is dominant to the allele for their absence (**t**).

A breeder found that a male horse with white markings always produced offspring with white markings when crossed with a female of any phenotype.

Describe this observation in terms of the genotype of this male horse.

_____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

2. **Figure 1.1** shows events occurring during the synthesis of a protein that is secreted from a cell.

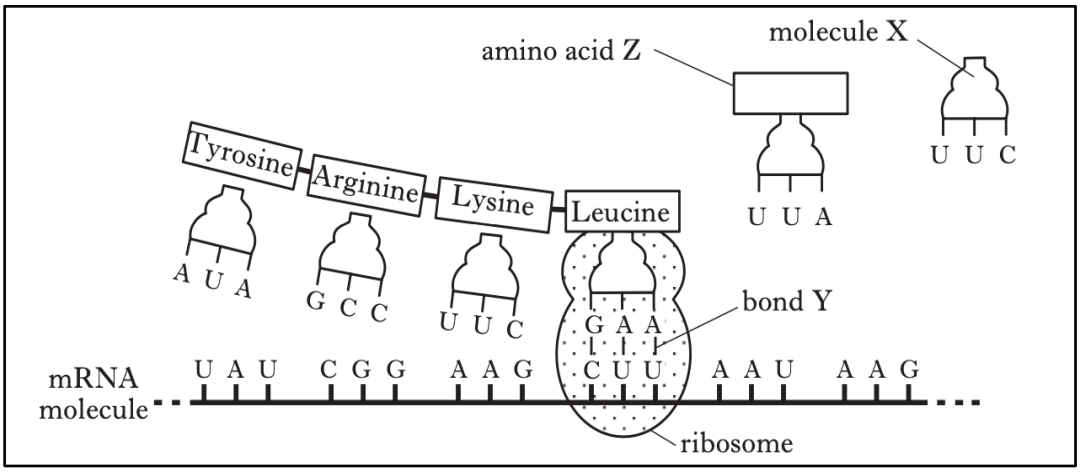


Figure 1.1

(a) (i) Name

molecule **X**: _____

bond **Y**: _____

Skill level 1	
1	
0	
NR	

(b) What name is given to a group of three bases on mRNA that codes for an amino acid?

_____

Skill level 1	
1	
0	
NR	

(c) Give the sequence of DNA bases that codes for amino acid **Z**.

_____

Skill level 1	
1	
0	
NR	

(d) Describe the roles of the endoplasmic reticulum between the synthesis of the protein and its release from the cell.

Skill level 2	
2	
1	
0	
NR	

QUESTION TWO: Environmental Biology **(16 scores)**

1. **Figure 2.1** shows seven lizards that are at risk of becoming extinct.

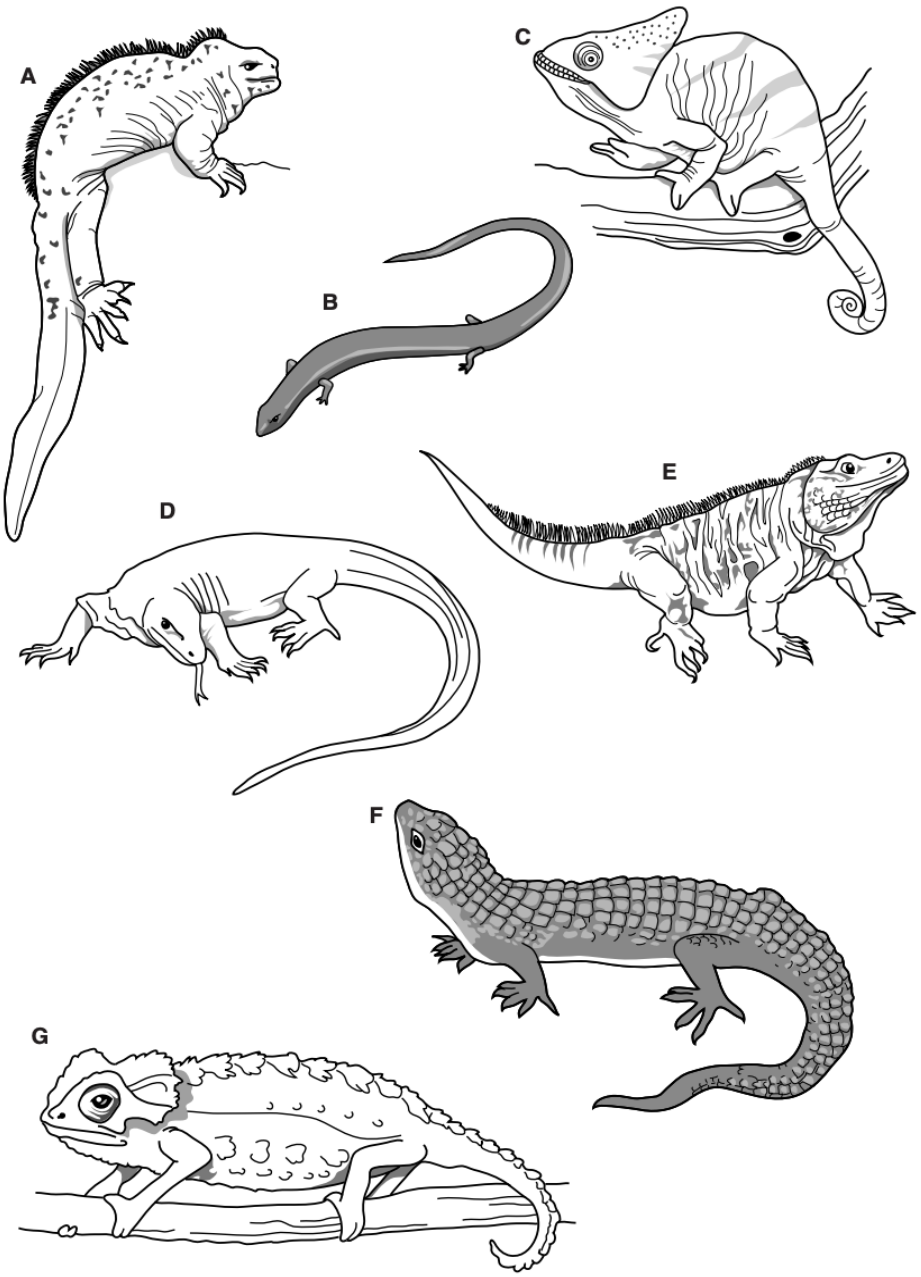


Figure 2.1

Skill level 1	
1	
0	
NR	

(a) (i) Name the vertebrate group that contains lizards.

_____

(ii) Use the key to identify each species. Write the letter of each species (**A** to **G**) in the correct box beside the key. One has been done for you.

KEY

		letter
1 (a) feet with three toes	go to 2	
(b) feet with five toes	go to 3	
2 (a) has a collar or crest on head	go to 4	
(b) has no collar or crest on head	*Chalcides minutus*	
3 (a) spikes along back	go to 5	
(b) no spikes along back	go to 6	
4 (a) ridges extend along back and tail	*Brookesia perarmata*	
(b) no ridges along back or tail	*Calumma parsoni*	
5 (a) blunt, rounded head	*Amblyrhynchus cristatus*	
(b) elongated head	*Cyclura lewisi*	
6 (a) large raised scales on skin	*Abronia graminea*	
(b) scales on skin are not large or raised	*Varanus komodoensis*	**D**

Skill level 2	
2	
1	
0	
NR	

(b) Explain the consequences on genetic biodiversity of having a wild population of just seven lizards.

_____

_____

_____

_____

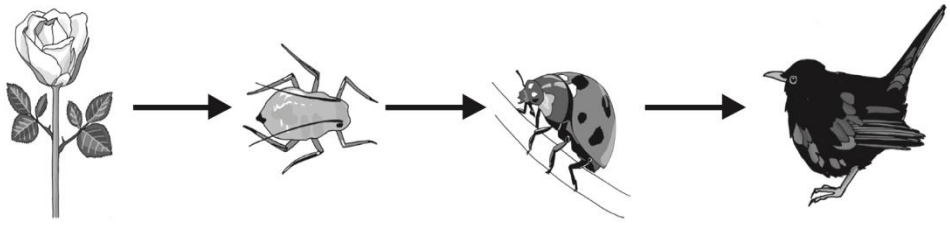
_____

_____

_____

Skill level 3	
3	
2	
1	
0	
NR	

2. (a) **Figure 2.2** below represents a food chain in a garden. (The organisms are not to scale.)



rose bush greenfly ladybird blackbird

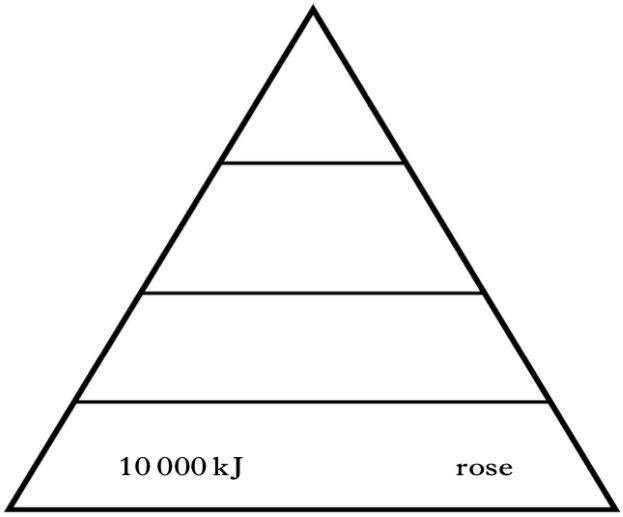
Figure 2.2

Skill level 1	
1	
0	
NR	

(i) What term describes the greenfly in this food chain?

_____

(ii) A rose bush contains 10,000 kJ/m^2/year of energy and only 10% of this energy is passed on at each stage of the food chain.
Use this information to complete the pyramid of energy below for this food chain.



Skill level 2	
2	
1	
0	
NR	

(iii) What happens to the energy that is not passed on at each stage of the food chain?

_____

_____

Skill level 2	
2	
1	
0	
NR	

(b) Many ladybirds were seen over the summer in the garden.
They were able to interbreed and produce fertile offspring.

What can be concluded about the ladybirds, using all this information?

_____

Skill level 1	
1	
0	
NR	

3. **Figure 2.3** below shows the plant communities that have developed around a fresh water lake.

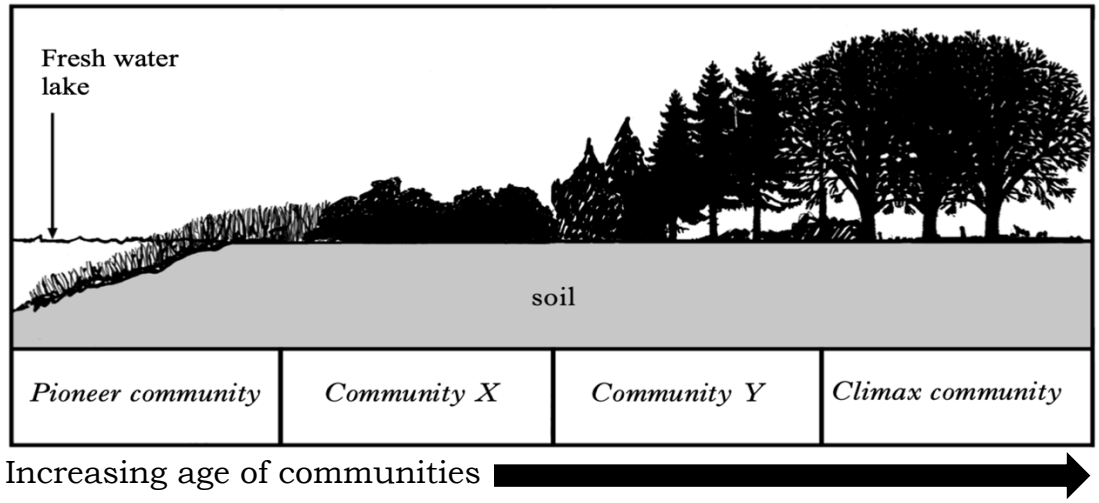


Figure 2.3

(a) What term describes the process of gradual formation of a climax community?

Skill level 1	
1	
0	
NR	

_____

(b) Suggest a modification that community **X** may make to its habitat which allows colonisation by community **Y**.

Skill level 1	
1	
0	
NR	

_____

_____

(c) Circle one alternative in each pair to make the sentences correct.

The complexity of the food web in the climax community will be

(greater than / less than) that in the pioneer community.

Greater species diversity will exist in (Community **X** / community **Y**).

Skill level 2	
2	
1	
0	
NR	

QUESTION THREE: Organism Level Biology (24 scores)

1. **Figure 3.1** below shows the human urinary system with its blood supply.

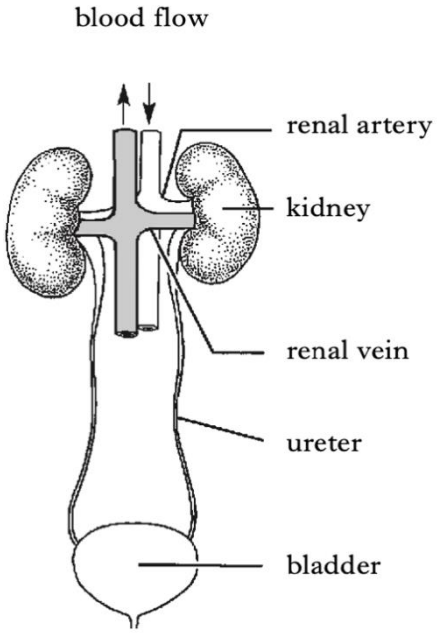


Figure 3.1

(a) An investigation was carried out to measure the concentration of three substances in samples of blood and urine.

Table 3.1 below shows the results of this investigation.

Sample site	**Concentration (grams per litre)**		
	Glucose	*Urea*	*Salts*
Renal artery	1.0	0.3	8.0
Renal vein	0.8	0.0	6.0
Ureter	0.0	20.0	15.0

Table 3.1

(i) Explain how the data in table supports the statement that urea is a waste product.

Skill level 3	
3	
2	
1	
0	
NR	

(ii) Name one substance, not shown in **Table 3.1**, which is present in urine.

Skill level 1	
1	
0	
NR	

_____

(b) Name the two processes in the kidney which cause the differences in salt concentration between blood and urine.

Skill level 1	
1	
0	
NR	

_____

(c) Freshwater bony fish use their kidneys to overcome a water balance problem.

Explain this problem and one method used by the kidneys to overcome it.

_____

_____

_____

_____

_____

_____

_____

Skill level 3	
3	
2	
1	
0	
NR	

2. (a) **Figure 3.2** below shows the small intestine with associated organs and blood vessels.

Key: ⟶ direction of flow

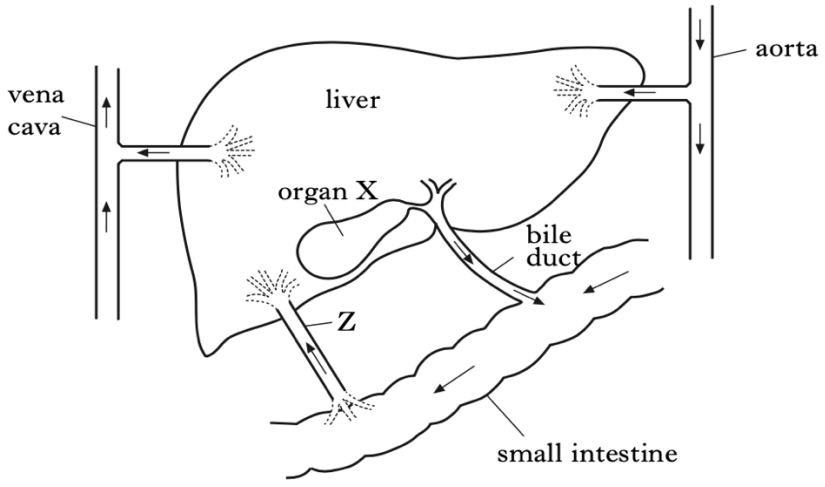


Figure 3.2

(i) Blood vessel **Z** carries amino acids to the liver.

Skill level 1	
1	
0	
NR	

(A) Name blood vessel **Z**.

_____

(B) Describe what happens to excess amino acids in the liver.

_____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

(ii) (A) Name organ **X**.

Skill level 1	
1	
0	
NR	

_____

(B) Describe the function of the bile that is released from organ **X**.

_____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

3. **Figure 3.3** shows the changes in the concentrations of two hormones during one menstrual cycle.

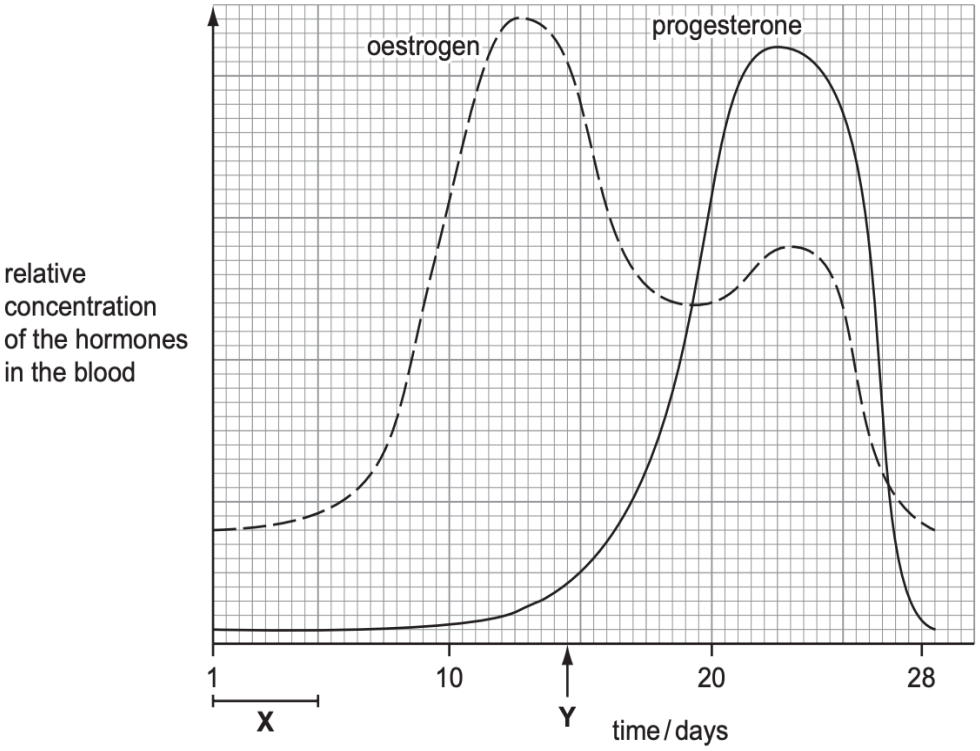


Figure 3.3

(a) State what happens at **X** ***or*** at **Y** during the menstrual cycle.

Skill level 1	
1	
0	
NR	

X _____

Y _____

(b) Describe the roles of oestrogen in controlling the menstrual cycle.

_____

_____

_____

_____

_____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

(c) Explain why it is important that progesterone is secreted after ovulation.

Skill level 3	
3	
2	
1	
0	
NR	

4. Discuss the advantages and disadvantages (to plants) of the mode of reproduction (either asexual or sexual) that it depends on to produce new plants using named examples

Skill level 4	
4	
3	
2	
1	
0	
NR	

QUESTION FOUR: Cellular Biology **(19 scores)**

1. Enzymes are biological catalysts. **Figure 4.1** shows how the enzyme, sucrase, breaks down a molecule of sucrose.

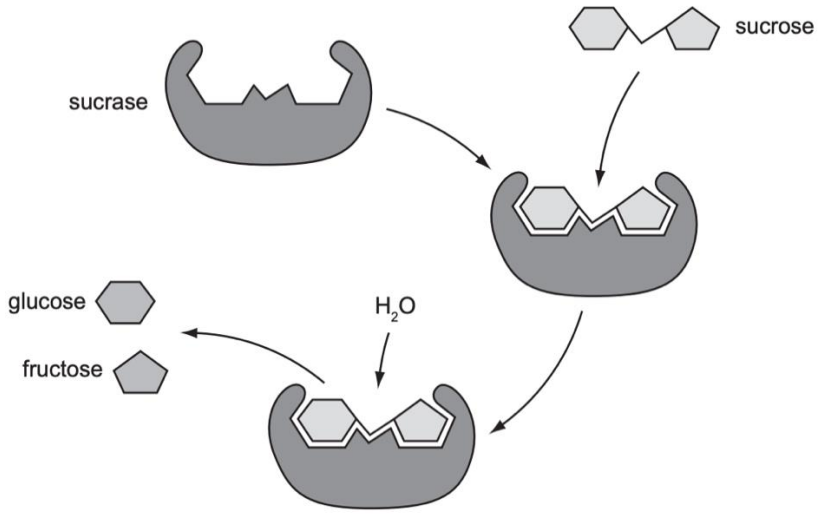


Figure 4.1

(a) Describe how sucrase catalyses the breakdown of sucrose. You should refer to **Figure 4.1** in your answer.

Skill level 2	
2	
1	
0	
NR	

2. (a) Samples of carrot tissue were immersed in a hypotonic solution at two different temperature for 5 hours. The mass of the tissue samples was measured every hour and the percentage change in mass calculated.

The results are shown on **Figure 4.2** below.

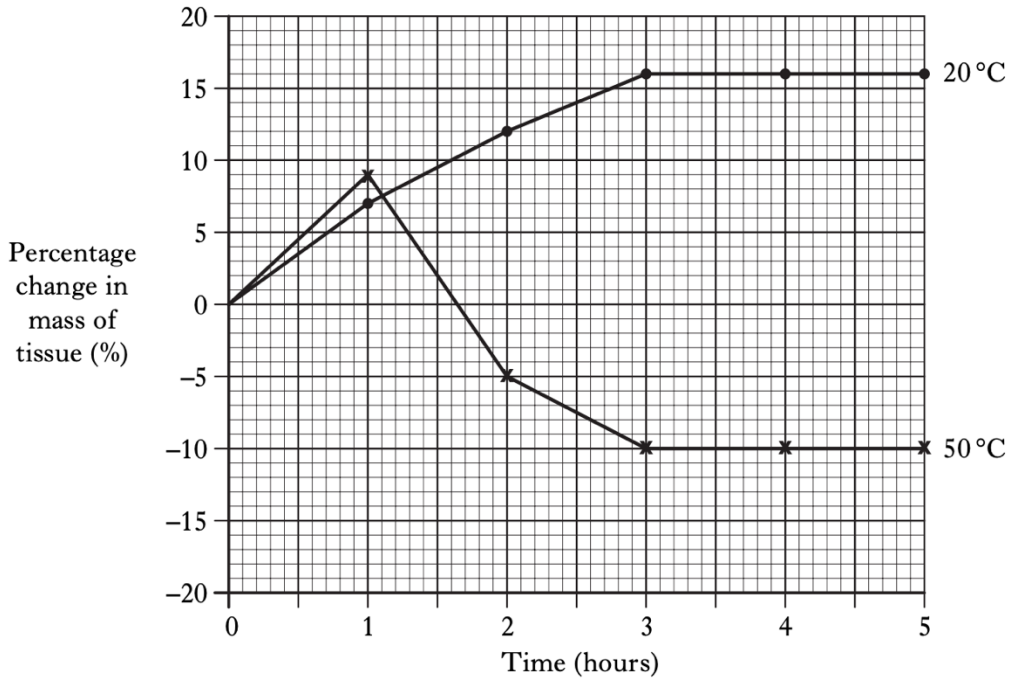


Figure 4.2

(i) Describe the results obtained at 20°C from 0 to 3 hours and form 3 hours to 4 hours.

0 to 3 hours _____

_____

_____

3 to 5 hours _____

_____

_____

Skill level 2	
2	
1	
0	
NR	

(ii) Describe the change in mass of the carrot tissue between 1 and 3 hours at 50°C.

_____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

(b) **Figure 4.3** below shows the concentration of ions within a unicellular organism and in the sea water surrounding it.

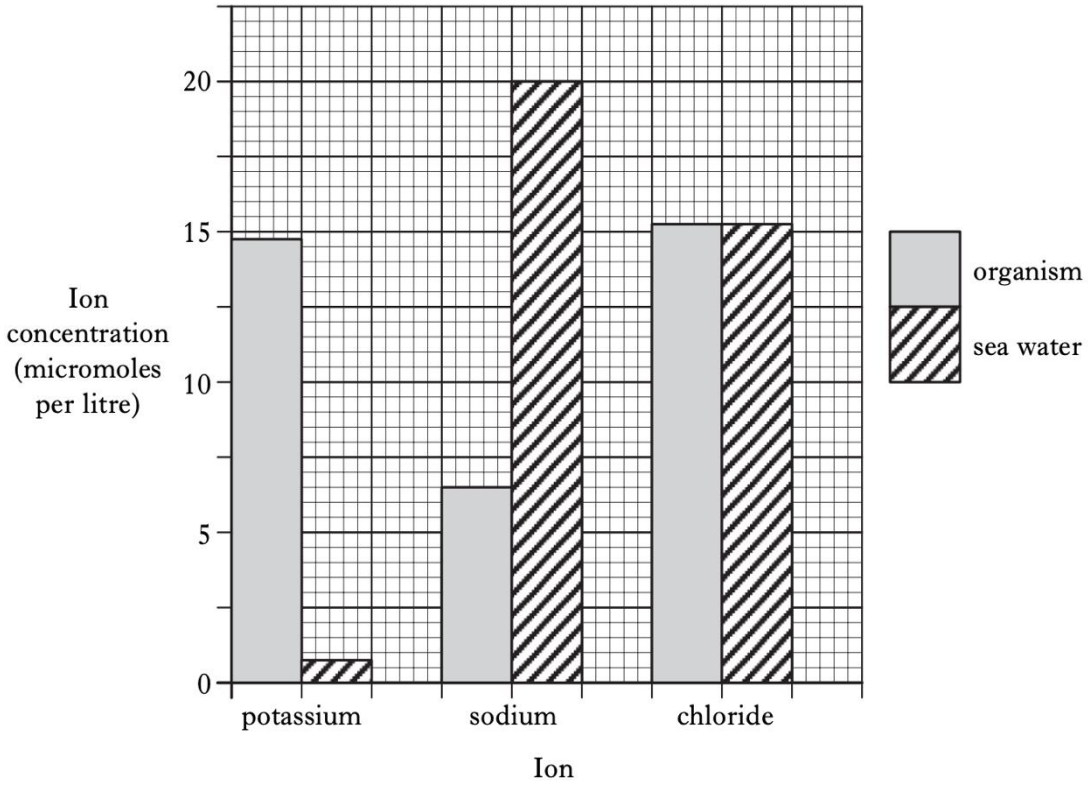


Figure 4.3

(i) From the information given, identify the ion which appears to move between the organism and the sea water by diffusion.

Justify your choice.

Ion _____

Justification _____

_____

_____

Skill level 2	
2	
1	
0	
NR	

(ii) When oxygen was bubbled through a tank of sea water containing these organisms, the potassium ion concentration within the organisms increased.

Describe this effect: _____

_____

_____

_____

Skill level 2	
2	
1	
0	
NR	

3. (a) **Figure 4.4** below shows part of the light dependent stage of photosynthesis.

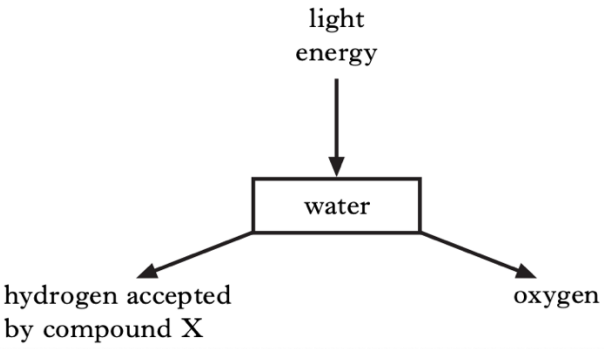


Figure 4.4

Skill level 1	
1	
0	
NR	

(i) Name this part of the light dependent stage.

_____

Skill level 1	
1	
0	
NR	

(ii) Name compound **X**.

_____

4. **Figure 4.5** below shows three stages that occur during aerobic respiration.

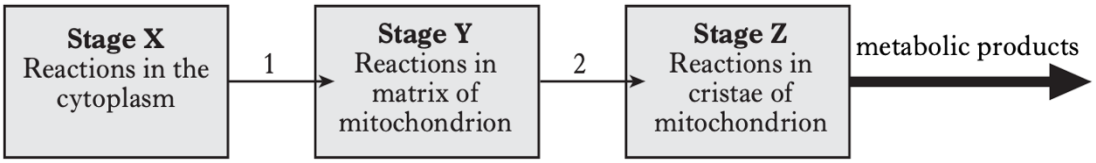


Figure 4.5

(a) Name any ***one*** of the three stages in **Figure 4.5**.

X _____

Y _____

Z _____

Skill level 1	
1	
0	
NR	

(b) (i) Arrows **1** and **2** represent the transfer of molecules from one stage to another in **Figure 4.5**.

Complete the table to identify ***only one*** of these molecules.

Arrow	*Name of molecule*
1	
2	

Skill level 1	
1	
0	
NR	

(ii) Name the two metabolic products of stage **Z**.

_____ and _____

Skill level 1	
1	
0	
NR	

5. Discuss the transport processes in specific areas such as guard cells in plants.

Skill level 4	
4	
3	
2	
1	
0	
NR	

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