education

Department:
Education
PROVINCE OF KWAZULU-NATAL

STEP AHEAD SOLUTIONS

LIFE SCIENCES

GRADE 11

JANUARY **2021**

Topic: Diversity and classification of Micro-organisms

Activity 1

1.1				
	1.1.1	A. Protein coat / Capsid ✓ B. Tail. ✓ C. Neck ✓ D. Tail fibres✓	4	
	1.1.2 1.1.3 1.1.4	They do not have a cell structure✓ (i) Reproduce/ die ✓ (ii) Do not fear/ do not respire ✓ Will not be able to reproduce/multiply, ✓ because they are obligate parasites/ can only reproduce inside a host cell. ✓	1 2 2	**9**

Activity 2

2.1				
	2.1.1	Acquired Immuno Deficiency Syndrome. ✓	1	
	2.1.2	HIV (Human Immune Virus) ✓	1	
	2.1.3	Can only reproduce inside a host cell/ living cell ✓	1	
2.2	2.1.4	-People may engage in unprotected sex✓ when intoxicated ✓ - High rate of prostitution✓ to get money for drugs✓ -The virus attaches itself onto the host cell ✓ -Virus injects its genetic material/ DNA/RNA into the cell ✓ -Viral genetic material combines with DNA/ genetic material of host cell✓ -Viral DNA multiplies/ replicates as host DNA multiplies/ replicates✓ - Viral DNA makes protein coats for itself ✓ - New viral particles split open the host cell and attack more host cells.✓	4 6	**13**

Activity 3

3.1				
	3.1.1	Able to make/ manufacture their own food ✓		
	3.1.2	Unable to make or manufacture their own food/ feed on other organisms✓		
	3.1.3	No true / definite nucleus/ no nuclear membrane ✓	3	
3.2	3.2.1	A only ✓✓		
	3.2.2	Both A and B ✓✓		
	3.2.3	Both A and B ✓✓		
	3.2.4	A only ✓✓		
	3.2.5	B only ✓✓ (2x5)	10	
				13

Activity 4: Protists (Malaria)

4.1	4.1.1	Protista✓	1	
	4.1.2	Take anti-malarial drugs✓ Use insect repellents on exposed skin✓ Sleep under bed-nets✓ Empty areas of standing water to prevent breeding of mosquitoes✓ any	2	
4.2	4.2.1	A female Anopheles mosquito✓ bites an infected person, the parasite is sucked in ✓and develops further in the vector and the mosquito bites another person✓ transferring the parasite. any	2	
	4.2.2	Antibiotics can only be used to treat diseases caused by bacteria✓ and the malaria is transmitted by a protist.✓	2	
	4.2.3	The economy will be negatively affected✓ as the cost of malarial treatment is high✓/decreased work production	2	
	4.2.4	From hospital records✓	1	
	4.2.5	Not all people affected go to hospital✓ in some areas	1	
				11

Home work (Bacteria and Viruses)

Differences between bacteria and viruses

Viruses	Bacteria
Have characteristics of both living and non-living things	They are living cells
Acellular	unicellular
Do not respire/ feed	They respire/ feed
Only reproduce in a host cell	Can reproduce on their own/ outside a host cell
No cell wall	Cell wall present
No cell membrane	Cell membrane present
No cell organelles, only genetic material	Cell organelles present

Rubric:
1 mark for table (with headings)
(2x7 for differences)

15

Activity 5 (Classwork): Summary of Micro-organisms

5		The table below summarises the diversity of micro-organisms. Complete the table under each appropriate column		
	5.1	Acellular ✓		
	5.2	Absent ✓		
	5.3	Monera ✓		
	5.4	Prokaryote ✓		
	5.5	Autotrophic and heterotrophic✓		
	5.6	Asexual (Binary fission)/ vegetative and sexual ✓		
	5.7	Protista ✓		
	5.8	Eukaryote ✓		
	5.9	Autotrophic and heterotrophic ✓		
	5.10	Sexual and asexual ✓		
	5.11	Fungi ✓		
	5.12	Eukaryote ✓		
	5.13	Heterotrophic✓		
	5.14	Asexual and sexual✓	14	
				14

Activity 6: (immunity)

6.1	6.1.1	Antibodies	1	
	6.1.2	Antibodies remain in the body/ are not weakened/last for a long time OR are not destroyed/ body continues to make antibodies/ cause an increase in the number of antibodies/ person as made own antibodies. (any 1x1)	1	
	6.1.3	Antibodies are weakened after a short time/ antibodies are made in an animal body/ they are not human antibodies/ person has not made own antibodies. (any 1x1)	1	
	6.1.4	So that more antibodies are made/ to keep antibody count high/ so body keeps making antibodies for a long time. (Any 1x1)	1	
	6.1.5	Injection of ready-made antibodies/ does not have to wait for antibody formation/ has large amount of antibody quickly available/ antibody start working straight away. (Any 1x1)	1	
				5

Topic: PLANT DIVERSITY

Activity 1

	1.1			
	1.1.1	(a) -Sporangium□ (b) -Calyptra□ (c) -Stalk□	(1) (1) (1)	
	1.1.2	(a) -Sporophyte□ (b) -Gametophyte□	(1) (1)	
	1.1.3	-B , Gametophyte□	(1)	
			[6]	

	1.2			
	1.2.1	(a) -Gametophyte□ (b) -Zygote□ (c) -Sporophyte□	(4)	
	1.2.2	(a) -fertilisation□ (b) -meiosis□	(1) (1)	
			[6]	

Activity 2

2.1				
	2.1.1	A- Bryophyte ✓ B- Pteridophyte✓	(2)	
	2.1.2	-Spores✓	(1)	
	2.1.3	-Haploid✓	(1)	
	2.1.4	-A✓	(1)	
	2.1.5	- it does not have true roots, stems and leaves✓	(1)	
			[6]	

Activity 3

	3.1			
	3.1.1	I-Pteridophytes✓ II-Bryophytes✓	(2)	
	3.1.2	-plant I produce spores whilst plant IV produces cones✓ -plant I depends on water for reproduction and plant IV does not depend on water for reproduction	(4)	
	3.1.3	- II✓	(1)	
	3.1.4	- II , I, IV ,III ✓✓	(2)	
			[9]	

Activity 4

	4.1			
	4.1.1	-Algae✓	(1)	
	4.1.2	-Angiosperms✓	(1)	
	4.1.3	-Gymnosperms and Angiosperms✓	(2)	
			[4]	

	4.2			
	4.2.1	A-Bryophytes✓ B-Pteridophytes✓ C-Gymnosperms✓ D-Angiosperms✓	(4)	
	4.2.2	(a) Presence of vascular tissue✓ (b) Ability to produce flowers✓/Seed enclosed by fruit✓	(1) (1)	
	4.2.3	-Spermatophytes✓ /Spermatophyta✓	(1)	
			[7]	

Activity 5

	5.1			
	5.1.1	- Wind	(1)	
	5.1.2	Produces large amount of pollen to ✓increase the chances of pollination. - Pollen grains are light, smooth ✓and dry to allow them to float. - Anthers are attached to their filaments in such a way that they are easily moveable with wind. ✓ - Stigma is large, feathery and sticky to trap as much pollen as possible. ✓ - Large anther - Small flowers without colourful petals. - Absence of petals / calyx for better exposure of pollen to wind. - Reduced scent and nectar. □ ✓ (Any 3 x 1)	(3)	
			[4]	

	5.2			
	5.2.1	1✓	(1)	
	5.2.2	7✓	(1)	
	5.2.3	-the stamens are shorter than the pistil /the gynoecium is longer than the androecium✓	(1)	
	5.2.4	-Angiosperm have a cuticle whilst Bryophytes do not -this cuticle protects the angiosperm from excessive water loss✓ Or -Angiosperm have true roots whilst bryophytes have rhizoids -true roots allow angiosperms to better obtain water from the ground✓ Or -Angiosperms produce seeds that are better protected from land elements than spores✓	(2)	
			[5]	

Activity 6

	6.1			
	6.1.1	A- style✓ B- anther✓ C- ovule✓ D- petal✓/corolla✓	(4)	
	6.1.2	-C✓	(1)	
	6.1.3	-petals are small, green and not showy✓ -long filaments and anthers (stamens) that hang outside the flower✓ -large amount of pollen produced✓ -small, light pollen granules✓ -stigma may be large and feathery✓ -does not have a scent or nectar ✓ (mark first TWO only)	(2)	
	6.1.4	-Offspring are genetically different from one another and their parents which gives them a better chance to survive/be adapted to new environments✓ -it is a way to leave behind parasites or diseases that parents might have✓ -the zygote is protected by a thick protective coat which increases the chances of survival.✓✓ -genetic variation may lead to new species developing✓ -it allows for selection of favourable characteristics✓ (mark first TWO only)	(2)	
	6.1.5	-they have vascular tissue/xylem and phloem✓ -they have a cuticle✓ -they do not rely on water for reproduction✓ -they produce seeds instead of spores which are resistant to desiccation ✓ (mark first TWO only)	(2)	
			[11]	

	6.2			
	6.2.1	Insect pollination✓	(1)	
	6.2.2	1-Stigma✓ 2-Anther✓	(2)	
	6.2.3	Perianth ✓	(1)	
	6.2.4	(a) 5✓ (b) 4✓	(1) (1)	
			[6]	

Activity 7

	7.1			
	7.1.1	-a oxygen deficient environment/minimal oxygen✓ -very cold temperature/a temperature of -18^{O}C✓✓	(1)	
	7.1.2	-global warming✓	(1)	
	7.1.3	-provides staple foods✓ -it is used to make beverages✓ -it is used to make spices✓	(3)	
	7.1.4	-Seed banks may store variations of crops that may be hardier to the disease and can replace those wiped out. ✓✓ -a seed bank stores unusual or rare varieties of crops that are not commercially farmed to maintain biodiversity✓ -A seed bank keeps cultures of plants that are not usually grown from seed in case they are needed to replace plants that go extinct in the wild✓✓ -Endemic species need to be preserved as they do not occur elsewhere in the world ✓✓ -Endangered species may be preserved in case they go extinct in the wild ✓✓ -Species may have the potential to provide us with substance of medicinal value ✓✓ -they must be preserved so that they can be studied before they go extinct.✓ (Any 2 x 1)	(2)	
			[7]	

	7.2			
	7.2.1	-they would sow/plant a predetermined number of seeds✓of each variety under the same conditions ✓ -they would then count the number of seedlings produced✓by each batch of seeds planted✓	(2)	
	7.2.2	-C✓	(1)	
	7.2.3	-72,5%✓	(2)	
	7.2.4	No of seedlings = 80✓/100 X 2100✓ = 1680 ✓	(3)	
	7.2.5	-the % germination of seeds decreases✓as time increases✓/ the percentage germination of seeds increases✓ as time increases/the amount of time that passes has no influence✓ on the germination of seeds✓	(2)	
	7.2.6	(a) seed age✓ (b) number of seeds that germinate✓	(1) (1)	
			[12]	

Topic: Animal Diversity

Teaching tool 4

Descriptions	Terminology
1. Body wall consisting of two germ layers	Diploblastic
2. A gut with only one opening, used for both ingestion	Blind gut
3. The concentration of sense organs into the anterior part of an organism to form a 'head' region	Cephalisation
4. The arrangement of body parts such that an organism can be divided into identical parts vertically along any radius	Radial symmetry
5. A gut having two openings, one for ingestion and one for egestion	Through gut
6. Body wall consisting of three germ layers	Triploblastic
7. The arrangement of body parts such that an organism can be divided into identical parts in only one way through the mid-longitudinal line	Bilateral symmetry
8. Blood system in which blood flows from the blood vessels into open spaces	Open blood system
9. The germ layer giving rise to cells form the muscles and other internal organs in the body	Mesoderm
10. Type of symmetry relating to organisms that have an irregular shape and can thus not be divided into two identical parts	Asymmetry
11. A true body cavity that is lined on both sides by mesoderm	Coelomate
12. Blood system in which the blood is always confined to the blood vessels	Closed blood system
13. The germ layer that gives rise to cells that line the gut	Endoderm
14. A body cavity that is line by mesoderm on one side only	Psuedocoelom

ACTIVITY 1

1.1. Porifera✓ (1)
1.2. Radially ✓ (1)

1.3. Organism A lacks true embryonic layer and organism B is diploblastic✓ (2)

1.4. (i) organism A has no true embryonic tissue layer
- as a result these organisms cannot move, they remain sessile in the aquatic environment for rest of their live time ✓
- the lacking of the ectoderm imposes limitation in the organism ability to respond to changes in the environment ✓ (3)

(ii) organism B has a radially symmetry and is diploblastic✓
- Sense organ are distributed along the central axis which enables the organism to respond to changes in the environment ✓
- Presence of an ectoderm enable organism B to move to search for food and defend themselves against predators✓

(3)

ACTIVITY 2

2.1.
(a) A✓
(b) B✓ (2)

2.2.
- Annelida✓
- Arthropoda✓
- Chordata✓

Any two (2)

2.3. mesoderm✓ (1)

2.4. bilateral symmetry✓ (1)

2.5 - it protects the animal against mechanical injury✓

-it provides the points of attachment for muscle✓ (2)

Activity 3

3.1. cnidarian✓ (1)

3.2. blind gut✓ (1)

3.3. -it has one opening so ingestion and egestion cannot happen ``````````simultaneously✓

-since food move in one direction, therefore the gut cannot become specialize✓ (2)

3.4.

- serve as a hydrostatic skeleton✓
- against which muscle act✓

OR

- It contains caulomic fluid✓
- Which spread over the body surface to prevent desiccation✓

Any two (2)

(6)

Activity 4

4.1 X - Gut✓
Y - Coelom✓ (2)

4.2 A✓ (1)

4.3 Triploblastic✓ (1)

4.4 B shows three germ layers/ectoderm, mesoderm and endoderm✓

4.5 Annelida✓, Arthropoda ✓ and Chordata✓ (2)

(Mark first TWO only)

4.6

-Provides space□
-for development of organs□

OR

-Contains fluid□
-which acts as hydrostatic skeleton□

(Mark first ONE only)

(2)

(9)

Activity 5

5.1 Through gut□ (1)

5.2. -The food enters the gut through one opening and leaves through the other opening✓
- thus preventing digested food to mix with undigested food✓

OR

-Each part of the gut becomes differentiated✓
-for effective digestion and absorption✓

Mark the first ONE only (2)

5.3 Arthropoda✓
Annelida✓
Chordata✓

(2)
Mark the first TWO

5.4

-The concentration of sense organs✓/nerves
at the anterior end of the body✓/to form a head region (2)

(7)

Activity 6

6.1 Arthropoda✓ (1)

6.2 Triploblastic✓ (1)

6.3 Exoskeleton✓ (1)

6.4 - It is impermeable, gas exchange can no longer occur throughout the body surface.✓
-It has specialised gas exchange openings.✓✓
-It cannot stretch to accommodate growth of the body.✓✓
- This is avoided by moulting at regular intervals.✓
(4)

6.5 - The body wall of the animals are separated from the gut wall✓/there is increased distance between the gut and other parts of the body making diffusion inadequate for transport of food, gases and excretory wastes.✓ (2)

(9)

Topic: photosynthesis

B. TERMINOLOGY

. **Complete the following table by filling in the correct biological terms.**

NO.	Description	Term
	A process whereby green plants manufacture their own food using radiant energy	Photosynthesis
	Organelle in a plant cell where photosynthesis occur	Chloroplast
	Green pigment that trap light for photosynthesis	Chlorophyll
	Occurs in the grana of the chloroplast	Light phase
	Occurs in the stroma of the chloroplast	Dark phase
	Energy carrier in the living things used for various activities	ATP
	Used to test for the presence of starch	Iodine solution
	Organisms that use light energy to manufacture its own food	Autotrophs
	A scientific procedure undertaken to make a discovery, test a hypothesis or demonstrate a known fact.	Experiment
	Sugar that is the product of photosynthesis	Glucose
	Leaf that has more than one colour	Variegated
	Special building that is used for growing plants in an area where they would not normally grow that well.	Greenhouse
	Process of eliminating starch reserves in a plant for experiments concerning photosynthesis	Destarch
	A variable that is not changed throughout an experiment	Control
	Organisms that are unable to manufacture their own food (consumers &decomposers)	Heterotrophs
	A carbohydrate that store energy in plants	Starch
	Factor that limits the rate at which photosynthesis takes place	Limiting factor

Activity 1

1.1

1.1.1 C ✓✓ (2)

1.1.2 B ✓✓ (2)

1.2

1.2.1 (a) Stroma ✓ (1)

(b) Ribosome ✓ (1)

1.2.2 It stores the starch ✓ (1)

1.2.3 Granum / Grana / Thylakoid ✓ (1)

Activity 2

2.1

2.1.1 Glucose ✓ (1)

2.1.2 Chloroplast ✓ (1)

2.1.3 Photolysis ✓ (1)

2.1.4 Stroma ✓ (1)

2.1.5 Starch ✓ (1)

2.1.6 Chlorophyll ✓ (1)

2.1.7 Radiant energy ✓ (1)

2.1.8 A only ✓ ✓ (2)

2.1.9 B only ✓ ✓ (2)

2.2

2.2.1 (a) C ✓ (1)

(b) A ✓ (1)

(c) B ✓ (1)

2.2.2 -B ✓ (1)

2.2.3 -A and C ✓ ✓ (2)

Activity 3

3.1

3.1.1 Adenosine diphosphate✓ (1)

3.1.2 ATP or adenosine triphosphate✓ (1)

3.1.3 It is the energy carrier in living systems/cells✓ (1)

Or it provides energy for all cellular activities✓ (ANY ONE) (1)

Activity 4

4.1

4.1

4.1.1 Sodium hydroxide/Soda lime/Potassium hydroxide ✓ (1)

4.1.2 Removes carbon hydroxide from the air in the jar ✓ (1)

4.1.3 The leaf turns blue-black ✓ (1)

4.1.4 -as the leaf was outside the jar, it was exposed to carbon dioxide ✓ (1)

-and could undergo photosynthesis/produce starch ✓ (1)

4.1.5 Dark phase /light independent phase ✓ (1)

4.1.6 Stroma ✓ (1)

4.1.7. To ensure that the starch at end of the investigation was produced ✓ during the experiment ✓ (2)

4.2

4.2.1 Graph C ✓ (1)

4.2.2 Due to carbon dioxide concentration ✓ (1)

4.2.3 Temperature ✓ (1)

4.2.4 The graph will show a steady increase in the rate up to 40^{O}C and a further increase in temperature will let it fall dramatically ✓ (2)

4.2.5

-At higher temperatures the enzymes become completely denatured/functionless ✓ (1)

-When the temperature is incfeased to 40^{O}C the temperature is optinum for maximun photosynthesis ✓ (1)

Activity 5

5.1

5.1.1 Destarch the plant ✓ (1)

5.1.2 (a) Leaf A ✓ (1)
(b)Leaf B ✓ (1)

5.1.3 Absorbs carbon dioxide ✓ (1)

5.1.4 Iodine solution ✓ (1)

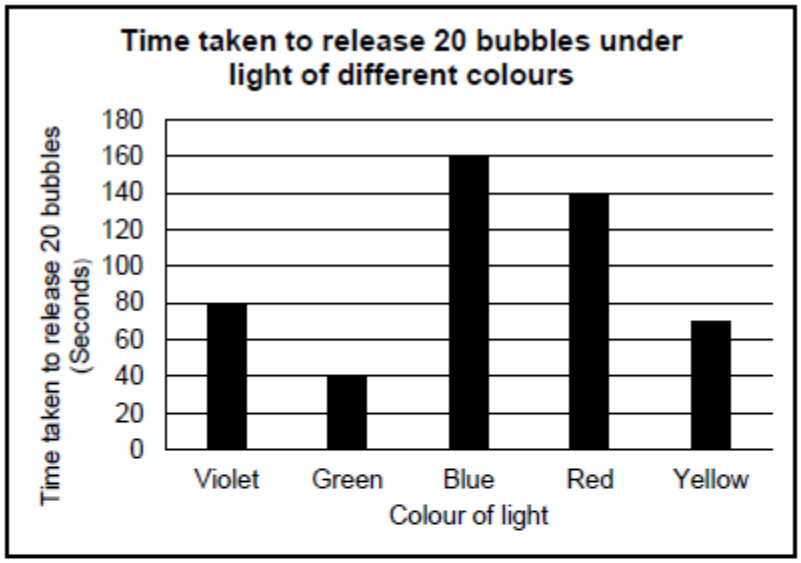
5.2

5.2.1 Blue-black ✓ (1)

5.2.2 (a) colour of light ✓ (1)
(b) rate of photosynthesis ✓ (1)
(c) the light intensity/the pondweed/the time exposed ✓ (1)

5.2.3 490/5 ✓ = 98s ✓ (1)

5.2.4



Mark allocation for the graph

Bar graph drawn (T)	1
Title of graph (both variables included)	1
Correct scale for X-axis (equal width and spacing of the bars) and Y-axis (S)	1
Correct label and unit for X-axis and Y-axis (L)	1
Plotting of bars (P)	0: No bars plotted correctly 1: 1 to 4 bars plotted correctly 2: all 5 bars plotted correctly

NOTE: If a line graph is drawn – marks will be lost for the 'type and scale'.
If a histogram is drawn – marks will be lost for 'type of graph and correct scale'. (6)

5.3

5.3.1 (a) Waterplants are structurally adapted to perform photosynthesis under water. ✓ (1)

(b) Addition of small amounts of sodium bicarbonate increases the concentration CO_2 ✓to bring about a steady rate of photosynthesis. (1)

5.3.2 By counting the number of bubbles released in a minute (unit time) ✓ (1)

5.3.3
- As the intensity of light increases ✓
- the rate of photosynthesis increases proportionately up to a certain point. ✓
- A further increase in light intensity ✓
- will cause no further increase in the rate of photosynthesis. ✓

(Any 3 x 1) (3)

5.3.4
- When the light intensity increases ✓
- the temperature increases proportionately ✓ which
- limits the performance of various enzymes ✓ and
- hence limit the rate of photosynthesis. ✓ (4)

Activity 6

6.1

6.1.1 Increases ✓ (1)

6.1.2 Greenhouse✓ (1)

6.1.3 Adenosine Triphosphate ✓ (1)

6.1.4 Chemical ✓ (1)

6.1.5 Atmosphere ✓ (1)

Activity 7

7.1

Oxygen ✓ (1)

7.1.1 - Take a glowing wooden splint ✓ and insert it in the mouth of the test tube

7.1.2 - If it ignites, ✓ the gas is oxygen (2)

- To release carbon dioxide ✓ into the water
- for photosynthesis to take place. ✓ (2)

7.1.3 - To see the oxygen which is a colourless gas ✓ (1)

7.1.4
- Increase the light intensity ✓
- so that the plant absorbs more light energy ✓ to increase the rate of photosynthesis
- Increase the temperature to optimum ✓

7.1.5 - will increase the rate of photosynthesis ✓ and therefore the rate of this experiment (4)

(10)

7.2 B ✓ ✓ (2)

Activity 8

8.1

8.1.1 D ✓ ✓ (2)

8.2

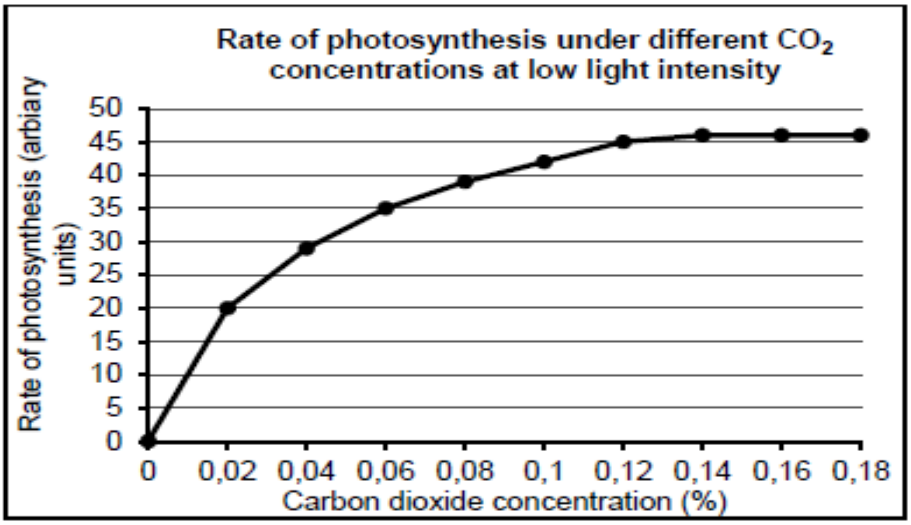
8.2.1 Rate of photosynthesis ✓ (1)

8.2.2 0,14% ✓ (1)

8.2.3 - Amount of water ✓
- Temperature ✓
- Light ✓

(Mark the first TWO only) (Any 2) (2)

8.2.4



Mark allocation for the graph:		
Line graph is drawn		1
Title of the graph (includes both variables)		1
Correct scale for x-axis and y-axis		1
Correct labels and units for the x-axis and the y-axis		1
Plotting of the points	0 points correct	0
	1–5 points correct	1
	All points correct	2
Only low light intensity graph is drawn		1

(7)

8.3

8.3.1 To demonstrate that light energy ✓ is necessary for photosynthesis. ✓ (2)

8.3.2 The presence/absence of starch ✓ (1)

8.3.3 (Dilute) iodine solution ✓ (1)

8.3.4 (a) No colour change / remain reddish brown ✓ (1)

(b) Turns blue-black ✓ (1)

8.3.5 (a) Carbohydrases ✓ (1)

(b) Salivary glands ✓ (1)

8.3.6 (a) Oxygen ✓/ O_2 (1)

(b) Oxygen ✓ / O_2 (1)

Activity 9

9.1

9.1.1 A ✓ ✓ (2)

ANIMAL NUTRITION

Activity 1

1.1

1.1.1 Egestion✓ (1)
1.1.2 Digestion✓ (1)
1.1.3 Assimilation✓ (1)
1.1.4 Absorption✓ (1)

(4)

Activity 2

2.1

2.1.1 a) Stomach ✓ (1)

b) Colon ✓ / Large intestine (1)

c) Anus ✓ (1)

d) Small intestine ✓ / Duodenum (1) **(4)**

2.2.2 a) B ✓ (1)

b) A ✓ (1)

c) C ✓ (1)

(3)

2.2.3 – Storage ✓

Deamination ✓
Detoxification✓
(Any 2) (2) **(2)**

Activity 3

3.1

3.1.1 Oesophagus✓ (1)

3.1.2 Peristalsis✓ (1)

3.1.3 P- Liver/ Pancreas✓ (Any order) (1) Q- Pancreas/ Liver ✓ (Any order) (1)

3.1.4 Stomach✓ (1)

(5)

Activity 4

4.1

4.1.1 Villus ✓ (1)

4.1.2 Small intestines✓ (1)
4.1.3 Epithelium cells ✓ (1)
4.1.4 connective ✓ (1)
4.1.5 Blood capillaries✓ (1)

4.1.6 Glucose ✓ (1)
4.1.7 Amino acids✓ (1)
4.1.8 Lacteal ✓ (1)
4.1.9 Fatty acids ✓ (1)
4.1.10 Glycerol ✓ (1)

(10)

Activity 5

5.1

5.1.1 A villus ✓ (1)

5.1.2 Columnar epithelium ✓ (1)
Lacteal vessel ✓ (1)

5.1.3 Small intestine ✓ (1)

5.1.4
- It is long, ✓ which means it has a very large surface area for absorption ✓
- It has many folds ✓which enlarges the surface area for maximum absorption of nutrients ✓
- Has millions of villi and micro-villi ✓which enlarge the surface area even further✓
- Has circular and longitudinal muscles ✓ responsible for the movement of food by peristalsis.✓

- Is a coiled tube which slows down the movement of food✓ (increases transit time) to ensure maximum absorption of nutrients. ✓
- The thin-walled ✓ villi (outer walls of villi are lined by a single layer of columnar epithelium) facilitate easy absorption✓

- Absorptive surface is kept moist✓ **by** digestive juices and mucus to facilitate diffusion of nutrients. ✓
- Villi are well supplied with blood capillaries and lacteals ✓ to ensure that absorbed nutrients are quickly transported away ✓

(Mark the first TWO only) (Any 2 X2)

(4)

5.1.5 **C** ✓ (1)

5.1.6 - The capillary flows in at **D** ✓

- Then absorption of nutrients will take place ✓
- From the small intestine into the capillaries in the villus ✓
- When the blood leaves at **C**, it will be rich with nutrients ✓
- (4) **(13)**

Activity 6

6.1

6.1.1 To create a similar condition to that of the body✓
It is the optimum body temperature✓ (2)

6.1.2 (i) mass/amount of sample✓ (1)
(ii) amount of gastric juice released in the stomach ✓ (1)

6.1.3 (i) fried eggs ✓ (1)
(ii) scrambled eggs ✓ (1)

6.1.4

Absorption

- Glucose ✓ in small intestine ✓ moves
- and by active transport ✓ which requires energy ✓
- and by diffusion ✓ passive/ no energy required ✓
- through the columnar epithelial cells ✓
- into the blood capillaries ✓
- of the villus. ✓ (Max 4) Max. 4

Transportation

- The blood capillaries in the villi join together ✓
- and eventually form the hepatic portal vein ✓
- This blood vessel carries the product to the liver ✓
- Processed nutrients, ✓ leave the liver in the hepatic veins ✓
- The hepatic veins join up with the inferior vena cava ✓
- that takes the blood to the heart ✓
- The heart then will pump the nutrient-rich blood to the whole body/cells/tissues ✓
- via the aorta ✓ (Max 4) (8) Max. **(14)**

Activity 7

7.1

7.1.1 (a) Pancreas✓ (1)

(b) Insulin ✓ (1)

(c) Glucagon ✓ (1)

7.1.2 Diabetes Mellitus ✓ (1)

7.1.3 Negative Feedback Mechanism ✓ (1) **(5)**

Activity 8

8.1

8.1.1 It is the cellular imbalance between the supply of nutrients and energy✓✓and the body's demand for them to ensure growth, maintenance, and specific functions. ✓ (2)

8.1.2 Kwashiorkor ✓ (1)

8.1.3 - Gastric glands in the stomach ✓

- secretes gastric juices✓ which
- contain the enzyme proteases. ✓
- that hydrolyse/digest proteins✓
- into polypeptides/peptones ✓
- and eventually into amino acids. ✓
- Protease only function best in an acidic medium. ✓ (5) **(8)**

Activity 9

9.1

9.1. Pure vegetarian✓ (1)

- Every level per unit volume in the diet is lowest✓, hence requiring intake of large amounts o✓f food. ✓
-digestion is generally incomplete✓, therefore less absorption of food is absorbed✓

(Mark the first ONE only) (Any 1 x 2) (2)

9.1.2 -very young children grow rapidly✓ and

-is difficult for them to consume enough vegetarian/ bulk food✓
-insufficient nutrients/ proteins/carbohydrates/vitamins/mineral✓
- causes malnutrition/kwashiorkor✓ / marasmus ✓
- Any 2) (2)

9.1.3 Plants/ part of plants/ ✓ specific name of plants/ supplements/ tablets✓(1)

9.1.4 10 000/40 000✓ X100✓

=25%✓ (3)

(9)

Topic : CELLULAR RESPIRATION

CLASSWORK/HOMEWORK ACTIVITY 1

1.

1.1 Cellular respiration – is the breaking down of glucose (organic compounds) ✓ so as to gradually release energy to all cells ✓

1.2 Aerobic respiration - is the process of cellular respiration that takes place in the presence of O_2✓

1.3 Anaerobic respiration - is the process of cellular respiration that takes place in the absence of O_2 ✓

OR

Anaerobic respiration – is the biochemical pathway taken by the process of cellular respiration in the absence O_2✓

1.4 Co-enzymes - are the non-protein partner that are carriers of high energy Hydrogen atoms in the oxidative phosphorylation stage of respiration ✓

OR

Co-enzymes - are organic compounds that act as Hydrogen acceptors / carriers during cellular respiration✓

1.5 ATP - is an energy carrier✓

1.6 Oxygen (O_2) - is the gas needed /required for the process of cellular respiration✓

OR

Oxygen (O_2) - is the final acceptor of Hydrogen atoms✓

1.7 Glycolysis – is a stage of cellular respiration that takes place in the cytoplasm / cytosol ✓

OR

Glycolysis – is anaerobic phase of respiration that occurs in the cytosol✓

1.8 Mitochondrion - is the organelle in a cell at which Kreb's cycle occurs✓

1.9 Kreb's Cycle - is a cyclic series of reactions that takes place in the mitochondrion✓

OR

Kreb's Cycle - is a phase of cellular respiration in which CO_2 is evolved✓

OR

Kreb's Cycle - is a phase of respiration which releases a large amount of energized hydrogen atoms✓

1.10 Ethanol – is a product, other than CO_2 of alcoholic fermentation in plants ✓

OR

Ethanol – is an organic product of anaerobic respiration in plants✓

1.11 Lactic acid – is an organic acid builds up in the muscle cells due to anaerobic respiration✓

1.12 Carbon dioxide(CO_2) - is a gas given off as a by-product during the process of cellular respiration✓

OR

Carbon dioxide(CO_2) - is a Gas evolved during process of cellular respiration✓ **(12)**

ACTIVITY 2

2.1 - Cellular respiration is the process at which glucose (organic compound) is broken down ✓

- So as to gradually release energy✓
- In a controlled way✓
- Oxygen(O_2) is required (needed) ✓
- Carbon dioxide (CO_2) is released as a by-product✓
- The released energy✓
- Is stored in ATP (energy carrier) molecules✓ (7)
-

2.2 In the cytoplasm✓ (2)
Mitochondrion ✓

2.3 - Aerobic✓ cellular respiration takes place in presence O_2✓ - Anaerobic✓ cellular respiration takes place in absence O_2✓ (4)

2.4 (a) Glucose✓ Oxygen✓ Enzymes✓ (3)

(b) Carbon dioxide✓ (CO_2) Water ✓ (H_2O) ATP✓ (3)

2.5 Glucose✓ + Oxygen✓ ------→ Carbon dioxide ✓ + Water ✓ + ATP✓
Enzymes✓

OR

$C_6H_{12}O_6$ ✓ + O_2✓ ----------→ CO_2 ✓ + H_2O✓ +ATP✓
Enzymes✓ (6)

2.6 - To constantly supply cells with of energy ✓ in the form of ATP
To perform the following processes: ✓

- Synthesis of organic molecules✓within cells
- Growth✓
- Cell division ✓
- Contraction of muscle fibres✓
- Movement ✓
- Transport of substances✓ within the body
- Active transport of substances ✓(movement of substances against the concentration gradient). (8)

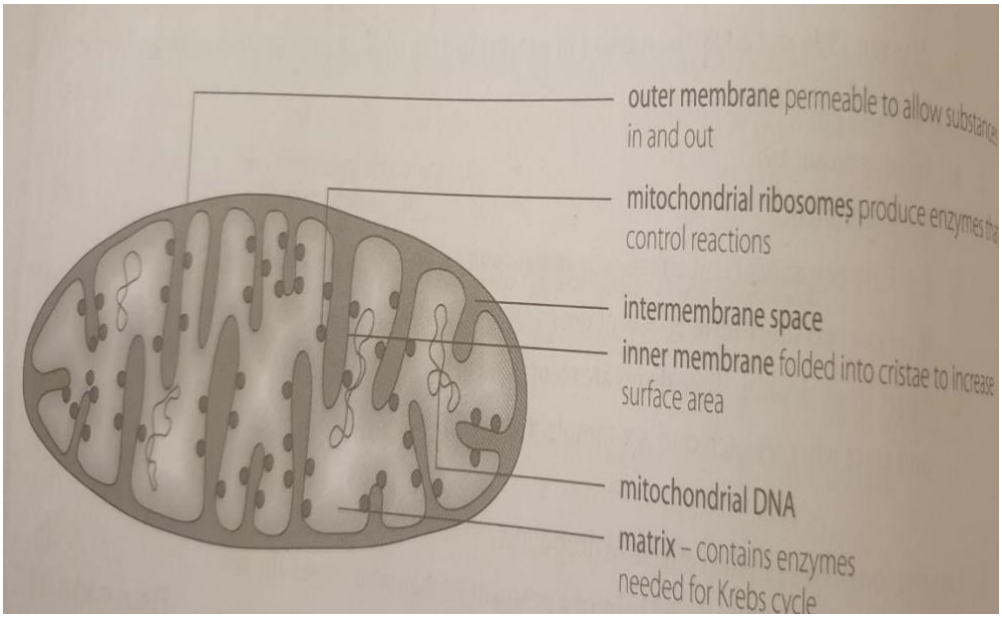
(33)

ACTIVITY 3

3. 3.1 Aerobic respiration is a process of cellular respiration that takes place in the presence of O_2✓ (2)

3.2 Glucose✓ Oxygen✓ Enzymes✓ (3)

3.3



Structure of the Mitochondrion✓

Mark allocation

Caption	1
Representative of mitochondrion	1
Any 4 correct labels	4

(6)

3.4 - Inner membrane is folded✓
to increase surface area✓ in which chemical reaction occur.
- Presence of ribosomes ✓ to make enzymes✓ needed/ required to catalyse the reactions
- Permeable membranes ✓ to allow the easy entry and exit of various substances✓
- Presence of enzymes✓ in the matrix to facilitate the Kreb's cycle✓/ the part of cellular respiration that occurs within the mitochondrion

(8)

3.5 Occurs in the cytoplasm✓ of the cell requires oxygen✓ to take place glucose (6 Carbon compound) is split into ✓ two (3 Carbon) compounds✓ called pyruvic acids✓ small amount of energy is released✓ that is used to form ATP✓ high energy H-atoms are also released✓ and are transported to the third phase✓ of aerobic cellular respiration

(10)

3.6 ATP✓/ Energy CO_2✓ H_2O✓ (3)

ACTIVITY 4

4.1

4.2 4.2.1 To investigate whether carbon dioxide is released during respiration ✓✓ (2)

4.2.2 A - Germinating seeds ✓

B - Damp cotton wood/ porous stopper✓ (2)

4.2.3 - The cotton must not touch the lime water✓
since the lime water will affect the germinating seeds. ✓
- The cotton wool/ porous stopper must be kept moist✓
to allow the seeds to germinate✓
- The test tube must be tightly sealed✓ to prevent CO_2 from the atmosphere entering✓/ or
- CO_2 released by the germinating seeds escaping.
(Any 2 x 2) (4)

4.2.4 - It is used to indicate whether CO_2 is produced or not✓
- If it is produced the lime water will turn milky✓
--If it not, it will remain clear ✓ (3)

4.2.5 Set up an identical apparatus but use boiled seeds which have been sterilized instead of germinating seeds which are rapidly respiring (2)

(13)

ACTIVITY 5

5.1 Anaerobic respiration Process of cellular respiration that takes place in the absence of O_2 ✓✓

OR

Biochemical pathway taken by the process of cellular respiration in the absence O_2✓✓ (2)

5.2 - It occurs in the absence of oxygen✓ - Glucose is partially broken down✓
- much less energy is released✓ in the form of ATP and
- in animal cells, lactic acid is formed✓ and it is
- called lactic acid it is usually fermentation
- in yeast cells, alcohol is produced✓ and it is
- called alcoholic fermentation (5)

5.3 - Making wine ✓
- In baking✓
- Beer making✓

- To produce daily products for example yoghurt, cheese, sour milk✓
  Mark the first THREE only (Any 3)

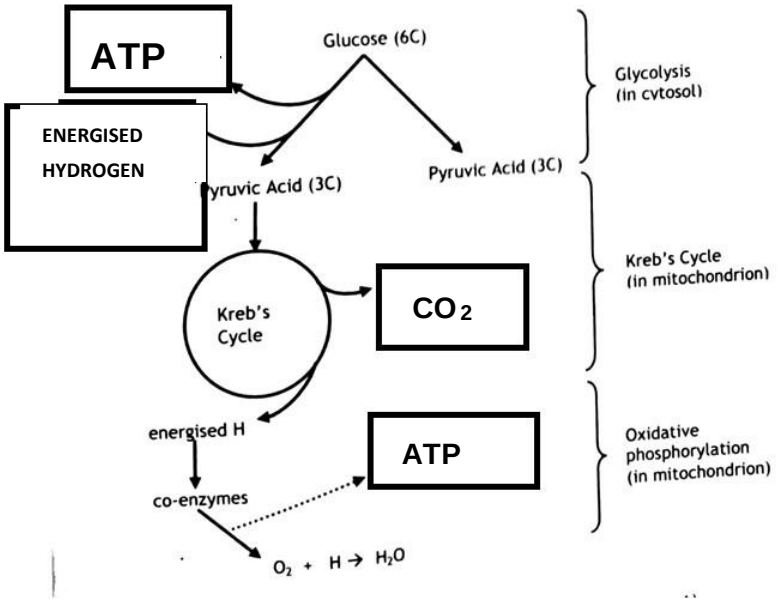
5.4

Aerobic Respiration	Anaerobic Respiration
- Large amount of energy is released✓– due to the complete breakdown of glucose	- Small amount of energy released✓ - due to the incomplete breakdown of glucose.
- End products are carbon dioxide and water✓	- End products are carbon dioxide and ethanol in fungi / plants or lactic in animals✓

(1 for table + 4) (5) **(15)**

ANNEXURE

Solutions for Teaching Tool 3



(4)

Topic: GASEOUS EXCHANGE

A. TERMINOLOGY

diffusion	the movement of molecules from a region of high concentration to a region of low concentration until equilibrium is reached
catabolism	the breaking down of complex molecules into simple molecules to release energy
aerobic	occurring in the presence of oxygen
anaerobic	occurring in the absence of oxygen
cellular respiration	the breakdown of organic compounds (glucose / sugar) in the mitochondria of cells into inorganic products (CO_2 and H_2O) with the release of cellular energy (ATP); either aerobic or anaerobic

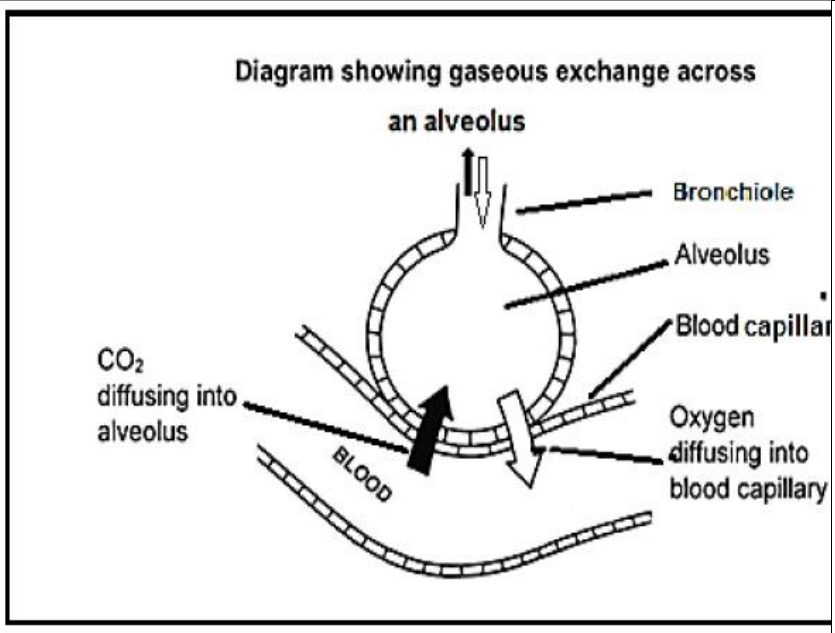
gaseous exchange	the exchange of O_2 and CO_2 at a respiratory surface occurs at **two** places in mammals: • at a gaseous exchange surface (lungs) and the blood • between the blood and the body cells at the tissue level
breathing	mechanical process of **inhalation** and **exhalation** through which air moves in and out of the respiratory organs enabling the uptake of oxygen and the removal of carbon dioxide.

Activity 1

1.1				
	1.1.1	A - Trachea✓ / cartilage ring D – Intercostal muscles✓	(2)	
	1.1.2	- Has (C-shaped) cartilaginous rings✓ which keep the trachea open✓ at all times to allow free flow of air Has cilia✓ which constantly move to push out dust particles and germs Contains mucus✓ which traps dust particles and germs✓ (Mark first ONE only) (Any 1 x 2)	(2)	
	1.1.3	(a) B - lung✓ C - diaphragm✓	(2)	
		(b) - Lung inflates✓ / enlarges/ volume increases/ pressure decreases -Diaphragm flattens✓ becomes less convex/ contracts	(2)	

				(8)

Activity 2

1.1				
	1.1.1	A – larynx ✓ B – trachea ✓ C – bronchioles ✓	(3)	
	1.1.2	Process 1✓	(1)	
	1.1.3	- Ribs are lifted/ chest expands/ moves outwards✓ - Thoracic cavity enlarges/ lungs are larger ✓ - Diaphragm contracts/ flattens/moves downwards✓ **(Mark first TWO only) (Any 2 x 1)**	(2)	
	1.1.4	D ✓ - intercostal muscle ✓ E ✓ - diaphragm ✓	(4)	
	1.1.5	 **Marks:** Diagram 1 Oxygen diffusion into blood 1 Carbon dioxide diffusion out of blood 1 Any other 2 labels 2	(5)	
	1.1.6	- Increases the amount of moisture in the air ✓ - because water evaporates ✓ - prevents drying out of inner surface of the lung ✓ - which would prevent gaseous exchange ✓ / gases can only diffuse in a solution.	(4)	
	1.1.7	- Cannot breathe/ inhale/exhale/lungs collapse ✓ - No pressure difference between exterior and thoracic cavity ✓	(2)	
			[21]	

Activity 3

1.1				
	1.1.1	Inhalation✓	(1)	
	1.1.2	-The diaphragm relaxes✓ -The external intercostal muscles relax✓ -Internal intercostal muscles contract✓ -Rib-cage moves inward✓ -Volume of thoracic cavity decreases✓ -Pressure on the lungs increases✓ -Air is forced out of the lungs✓ (Any 5)	(5)	
	1.1.3	-As bicarbonate ions✓ -As carbhaemoglobin✓ -Dissolved in the plasma✓ (Any 2)	(2)	
				(8)

Activity 4

1.1			(1)	
	1.1.1	A – Bronchus/ bronchioles✓		
	1.1.2	Gaseous Exchange/diffusion✓	(1)	
	1.1.3	(a) Carbon dioxide✓ (b) Oxygen✓	(2)	
	1.1.4	-numerous alveoli/ large surface area✓ for exchange of gases -thin epithelium made of single layer of cells✓ for rapid diffusion -presence of blood capillaries✓ for transport of gases. (Any 2)	(2)	
				(6)

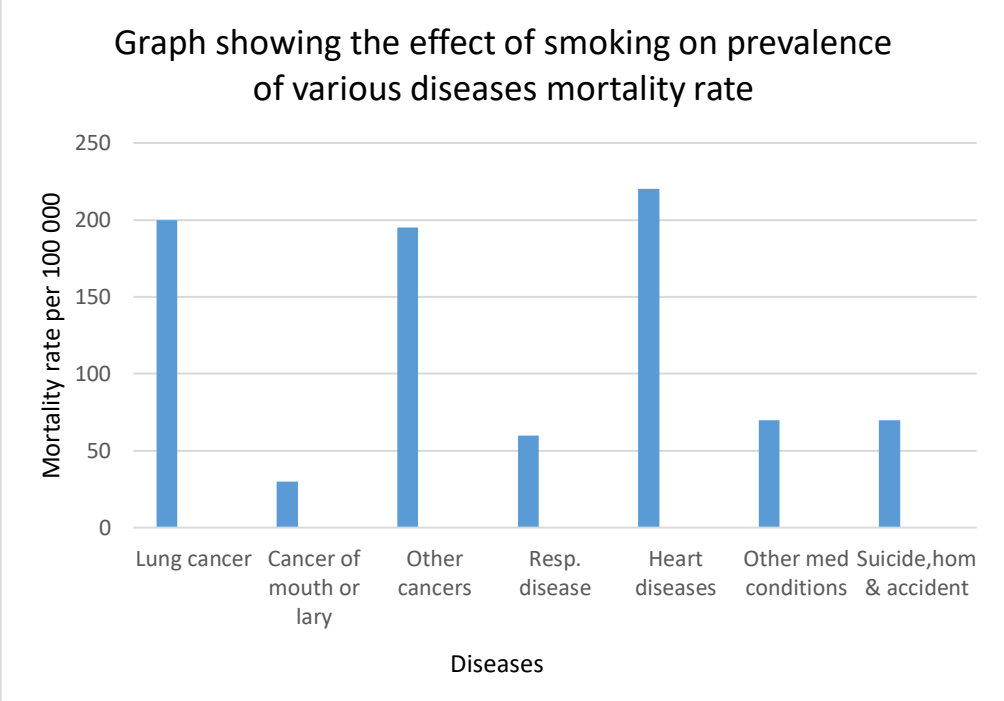
Activity 5

1.1				
	1.1.1	Squamous✓ epithelium	(1)	
	1.1.2	- Epithelium is thin✓ / flat/ has a single layer of cells to enable gases to diffuse through it quickly✓ -Epithelium is moist✓ to enable gases to diffuse through it quickly✓	(2)	
	1.1.3	Red blood corpuscle✓ / Red blood cell/ Erythrocyte	(1)	
	1.1.4	(a) Deoxygenated ✓ blood (b) Oxygenated ✓ blood	(1) (1)	
	1.1.5	High✓	(1)	
	1.1.6	Gaseous Exchange✓ / diffusion	(1)	
	1.1.7	- As bicarbonate ions✓ / carbonic acid - In solution in blood plasma✓		

		- As carbaminohaemoglobin✓/ carbhaemoglobin	(3)	
				(11)

Activity 6

1.1				
	1.1.1	To determine the effect of different concentrations of carbon dioxide✓ on the rate and depth of breathing✓ on volume of air breathed in	(2)	
	1.1.2	(a) -With a low carbon dioxide concentration there is a gradual increase of the rate✓ then it becomes constant ✓ -With a further increase in the carbon dioxide concentration it increases sharply✓ (b) - Initially there is a gradual increase in volume✓ and as the concentration of carbon dioxide increases, the volume increases✓ sharply	(3) (2)	
	1.1.3	Less carbon dioxide is being removed✓ since the depth of breathing is not increasing✓	(2)	
	1.1.4	-During the strenuous exercise the carbon dioxide level in the -blood increases✓ sensory cells in the carotid arteries and aortic -arches ✓ in the medulla oblongata✓are stimulated ✓ causing it to -stimulate the heart to beat faster✓ thus carbon dioxide is -transported faster✓ to the lungs from the tissues -The medulla also sends impulses to intercostal muscles, -diaphragm and abdominal muscles✓ -Contraction of the abdominal muscles pushes the diaphragm with - more force✓ causing the breathing movements to speed up✓ -Carbon dioxide is thus removed quickly and oxygen is taken up -more rapidly✓ (Any 5)	(5)	
				(14)

<table>
<tr><td>1.1</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>1.1.1</td><td>Mortality tare per 100 000 ✓</td><td>(1)</td><td></td></tr>
<tr><td></td><td>1.1.2</td><td>


<table>
<tr><td></td><td>1</td></tr>
<tr><td>Type of graph shows relationship between the two variables (V)</td><td>1</td></tr>
<tr><td>Correct label for X-axis and Y-axis(L)</td><td>1</td></tr>
<tr><td>Correct scale for X-axis (equal width and spacing of bars) (S)</td><td>1</td></tr>
<tr><td>Drawing of bars (B)</td><td>1 (1 to 3 bars correct)
2 (4 to 7 bars correct)</td></tr>
</table>
</td><td>(6)</td><td></td></tr>
<tr><td></td><td>1.1.3</td><td>220 ✓</td><td>(1)</td><td></td></tr>
<tr><td></td><td>1.1.4</td><td>5 active smokers: 4,6 passive smokers: 1 non-smoker ✓✓</td><td>(2)</td><td></td></tr>
<tr><td></td><td>1.1.5</td><td>- same age of participants✓
- same gender of participants ✓
- same socio-economic group ✓
- people from same area/ environment ✓
(Mark first TWO) (Any 2 x 1)</td><td>(2)</td><td></td></tr>
<tr><td></td><td>1.1.6</td><td>Both active and passive smokers have high prevalence of lung cancer ✓</td><td></td><td></td></tr>
<tr><td></td><td>1.1.7</td><td>- causes the walls of the alveoli to tear and form holes ✓
- Blood capillaries also disintegrate ✓
- smoke irritates tender tissue of bronchioles ✓
- gaseous exchange becomes difficult ✓</td><td>(3)</td><td></td></tr>
</table>

			(15)	

Activity 7

1.1				
	1.1.1	Mycobacterium tuberculosis✓	(1)	
	1.1.2	Antibiotics ✓	(1)	
	1.1.3	- Excessive coughing✓ - Tiredness✓ - Weakness ✓ - Loss of appetite and weight✓ **(Mark first THREE) (Any 3 x 1)**	(3)	
	1.1.4	AIDS ✓	(1)	
			[6]	

Topic: Human excretion

Activity 1

ORGAN	WASTE PRODUCT/S	ORIGIN	PRODUCT EXCRETED
1. Lungs	CO_2 and water	Cellular Respiration	CO_2 and water in exhaled air
2. Skin (sweat glands)	Mineral salts, traces of urea and water	Extracted from blood	Perspiration (sweat)
3. Liver	Urea	Deamination of excess amino acids	faeces
	Bile pigments	Breakdown of Haemoglobin	faeces
4. Colon	Bile pigments Excess mineral salts	Breakdown of Haemoglobin in the liver	faeces
5. kidney	Urea	Deamination of excess amino acids	Urine
	Mineral salts	Excess taken in with food	Urine
	Water	Excess water consumed and taken in with food	Urine

Activity 2

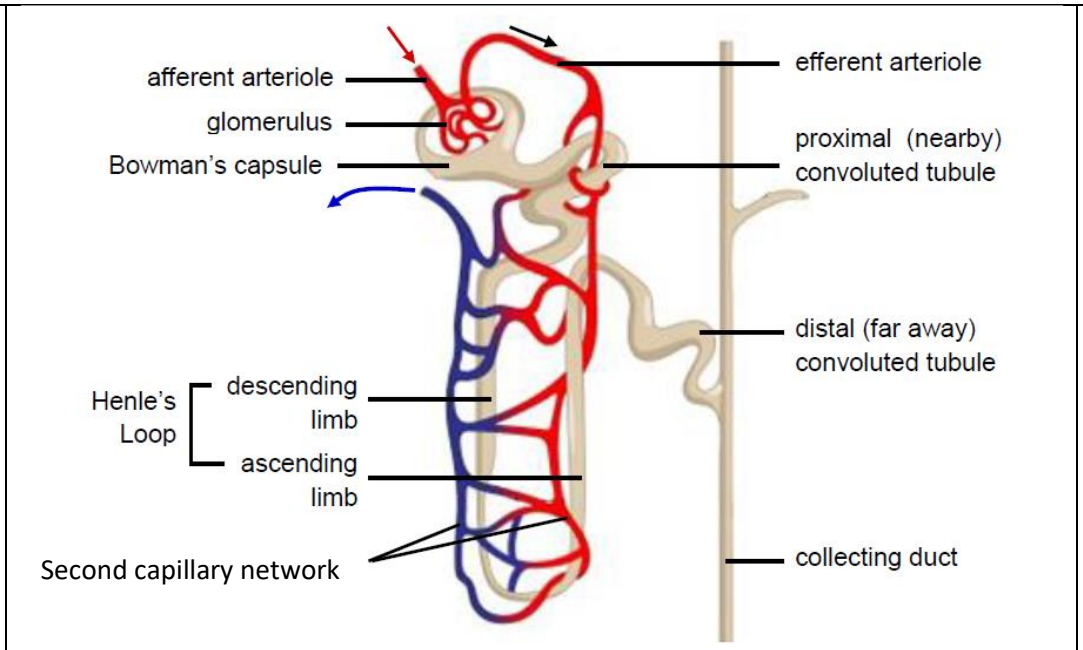
2.				
	2.1	A - renal artery✓ B - renal vein✓ G - urinary bladder✓ I – Adrenal gland✓		(4)
	2.2	C - cortex✓ D - medulla✓		(2)
	2.3	E - protects the internal parts of the kidney✓ F - carries urine from the kidney to the urinary bladder✓ H – carries urine from the urinary bladder to the exterior✓		(3)
	2.4	- By blood as bicarbonate ions✓ - In solution by blood plasma and erythrocytes✓ - By erythrocytes in the form of carb(amino)haemoglobin✓		(3)
	2.5			(4)
	2.6	(a) A✓ - renal artery✓ (b) D✓ - medulla✓ The kidney - Excretes waste products e.g. urea, uric acid, creatinine and drugs✓ - Osmoregulation – regulates the water content of body fluids✓ - Maintains osmotic ptessure of body fluids – by excreting excess salts and retaining water and glucose✓ - Regulates the pH of blood plasma – controls the acid-base balance in the blood✓		(4)
				(20)

Activity 3

3.				
	3.1	A: Renal capsule✓ E - Pelvis✓ F: Renal calyx✓		(3)
	3.2	E✓ - Renal Artery ✓		(2)
	3.3	B – contains the Malphigian bodies✓ (blood vessels - red) while region C has the renal tubules✓		(2)
	3.4	- Protects the internal parts of the kidney✓ - Prevents friction as the kidney swells and rubs against the ribs✓		(2)
	3.5	(a) B✓ (b) C✓		(3)
	3.6	(c) H✓ When the body loses too much water✓ - the hypothalamus is stimulated✓ - It secretes more ADH✓ - which makes the kidney tubules more permeable✓		(5)
	3.7	- allowing for more water to be re-absorbed into the blood✓ - thus causing less water to be lost in the urine✓ (Any 5) - the flow of urine into the bladder will be blocked✓ - results in an accumulation of urine in the kidney✓		(3)

		- can lead to kidney becoming non-functional✓/ accumulation of urea/ prevents osmoregulation/ pH balance will not be maintained		
				(20)

Activity 4

4.		

REGION	STRUCTURE	FUNCTION
1. Malpighian body	1.1 Bowman's capsule	To house the glomerulus
	1.2 Glomerulus	To allow for filtration to occur and prevent large molecules e.g. proteins from passing
2. Blood vessels	2.1 Renal artery	Carries oxygenated blood with lots of nitrogenous wastes
	2.2 Afferent arteriole	Carries blood at a higher pressure into the glomerulus
	2.3 Efferent arteriole	Carries blood at a lower pressure out of the glomerulus
	2.4 Second capillary network	To absorb useful substances from the renal tubule and to remove waste substances from the blood into the renal tubule
	2.5 Renal vein	Carries deoxygenated blood with no nitrogenous wastes
3 Kidney tubule	3.4 Proximal convoluted tubule	To actively re-absorb all glucose molecules from the filtrate in the renal tubule
	3.5 Loop of Henle	Is the Sodium Pump mechanism to regulate the salt concentration in the blood
	3.6 Distal convoluted tubule	Regulates salt and water in the blood
	3.7 Collecting duct	Urine containing all nitrogenous wastes e.g. urea, uric acid, creatinine, salts and

		water, is passed into the duct of Bellini and then into the bladder

Activity 5

5.1				
	5.1.1	A - Afferent arteriole✓ B - Bowman's capsule✓ C – collecting tubule✓		(3)
	5.1.2	1 - Glomerular filtration✓ / ultra-filtration/ filtration 2 - Re-absorption✓ / tubular reabsorption 3 - (tubular) excretion✓/ secretion		(3)
	5.1.3	- increases cell respiration✓/ to release more energy/ ATP - for the tubule to absorb substances by active		(2)
	5.1.4	absorption✓/ against the concentration gradient - It allows a high pressure✓		(2)
	5.1.5	- in the glomerulus - allowing filtration Any 2 - Under the influence of ADH✓/ Vasopressin - produced in the pituitary gland✓ - when the hypothalamus is stimulated✓ - part C becomes more permeable to water - More water is thus re-absorbed✓/ moves by osmosis / leaves the collecting tubules - back into the medulla✓ - and into the capillary network✓/ blood - The water content of the urine is thus low✓/ urine is concentrated		(6)

		- Part G is, therefore, responsible for osmoregulation Any 6		
				(16)

5.2				
	5.2.1	Podocytes✓		(1)
	5.2.2	(a) Protein✓		(1)
		(b) Glucose✓		(1)
	5.2.3	1,50 – 0,72✓ = 0,78✓ g/100 cm^3✓		(3)
	5.2.4	- Large amount of water✓ - is reabsorbed from the tubule into the medulla✓ **OR** - Some urea is added✓ - into the distal convoluted tubule✓/part 5		(2)
				(8)

Activity 6

6.1	6.1.1	(a) D✓ - contains proteins/highest flow rate ✓		(2)
		(b) B✓ - High concentration of glucose, but no proteins✓		(2)
		(c) C✓ - No glucose, and sodium ion and urea lower in concentration than D✓		(2)
		(d) A✓ - has the highest concentration of urea✓		(2)
	6.1.2	- High flow rate in D because of heart beat/ arterial blood ✓ - flow rate decreased in glomerulus ✓ - because of smaller diameter of capillaries✓ / flow divided into many capillaries - also flow rate is decreased as the fluid passes through membranes ✓		

		- hence low flow rate when fluid enters capsule✓ - where pressure of heart beat is absent ✓ - also large volume comes in and has to squeeze out through smaller volume allowed by efferent arteriole✓therefore slows it down. (Any 5)		(5)
	6.1.3	- Cells of the glomerular membrane are damaged✓ - proteins can be forced through and will then appear in urine✓		(2)
	6.1.4	- Excretion✓ of urea, sodium ions and ammonium ions - Re-absorption/regulation of glucose✓ - Osmoregulation✓ (Mark first TWO only) (Any 2)		(2)
	6.1.5	No ✓ - all amino acids are re absorbed into the blood✓		(2)
		(a) Sodium/Na✓		(1)
	6.1.6	(b) - to create a hypertonic tissue fluid✓ - so that water can be reabsorbed by osmosis from the collecting ducts✓		(2)
	6.1.7	- Cup shaped ✓ - to allow a large surface area✓ available for filtration - podocytes ✓ with slits - to filter ✓ the tissue fluid		(4)
	6.1.8	- when the sodium ions in the blood increases✓ - less aldosterone is secreted✓ - from the adrenal gland into the blood✓ - more sodium ions are actively pumped from the blood into the medulla✓ - to be excreted into the duct of Bellini✓/ passed out as Urine - Hence, the increase in Sodium ions between part C (Loop of Henle) and part A (Duct of Bellini) (Any 4)		

				(4)
				(30)

6.2				
	6.2.1	Protein✓ - they are too large to pass through the pores✓ - into the nephron✓ / no protein present in the filtrate		(2)
	6.2.2	(a) glucose is a useful substance✓ - and is thus completely re-absorbed✓ - from the tubule✓/ the capillary network/ blood		(3)
	6.2.3	(b) More salts are added✓ to the tubule/ nephron - from the second capillary network✓/ blood - during tubular excretion✓ - when they are in excess in the body✓ - Some water from the filtrate is re-absorbed✓ - Increasing the concentration of salts✓ Any 3		(3)
	6.2.4	- A shortage✓ of insulin✓ in he body **OR** - Person suffers from diabetes mellitus✓✓ **OR** - Re-absorption of glucose does not take place completely✓ (Any 1 x 2))		(2)
		No✓ Large percentage of water✓ - Was allowed to pass out as urine✓ **OR** A small percentage of water✓ - Was re-absorbed✓ **OR**		

		Urine produced✓ - Is very dilute✓ (1 + Any 1 x 2)		(3)
				(13)

Activity 7

7.				
	7.1	A - Bowman's capsule✓		
		B - Proximal convoluted tubule ✓		(2)
	7.2	Glucose ✓		(1)
	7.3	Urea ✓		(1)
	7.4	When it enters it has a high concentration ✓ - when it leaves it has a low concentration ✓ - Active reabsorption took place ✓ - against the concentration gradient ✓ - That is from a low to a high concentration ✓ - This chemical transport mechanism requires energy ✓ - This is provided by the epithelial cells ✓ - Some of the glucose is used along the nephron to provide energy ✓ (any 5)		(5)
	7.5	The volume of water in the blood decreases ✓ - osmoreceptors in the hypothalamus ✓ are stimulated - and messages sent to the pituitary gland✓ - which secretes more ADH ✓ into the blood - ADH increases the permeability✓ - of the walls of the distal convoluted tubules and the collecting ducts ✓ - This causes more water to leave the tubules by osmosis✓ - The amount of water in the blood increases ✓ and		(6)

		concentrated urine is formed - and less water is excreted from the body✓ (any 6)		
				(15)

Activity 8

8.1				
	8.1.1	To create a greater surface area✓ for the movement of substances into the dialysis fluid✓		(2)
	8.1.2	It must be selectively permeable/have small holes✓ to allow filtration of substances✓		(2)
	8.1.3	It should contain the same amount ✓ of useful substances like mineral salts, glucose, amino acids etc than the blood of the patient✓ It should not contain any✓ excretory wastes such as urea, creatine, uric acid etc✓ Blood needs to be filtered continuously✓		(4)
	8.1.4	The kidney machine can only be used from time to time✓ If kidney machine is used continuously✓ it will negatively affects the patient's life style✓ (any 2)		(2)
				(10)

<table>
<tr><td>8.2</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>8.2.1</td><td>- It allows certain substances (excretory substances) to pass through✓
- And prevents other substances (useful) and blood components from passing through✓</td><td></td><td>(2)</td></tr>
<tr><td></td><td>8.2.2</td><td>Same amount of useful substances✓ e.g. salt, amino acids, glucose etc.✓ - useful substances will not diffuse out of the blood✓
- No excretory wastes✓- Allows excretory wastes to diffuse out of the blood into the dialysis fluid✓</td><td></td><td>(4)
(2)</td></tr>
<tr><td></td><td>8.2.3</td><td>37^0C✓ - the same as body temperature✓</td><td></td><td></td></tr>
<tr><td></td><td>8.2.4</td><td>Air bubbles could create a blockage in the blood vessels of the patient✓ and lead to the death of the patient✓</td><td></td><td>(2)</td></tr>
<tr><td></td><td>8.2.5</td><td>- Treatments occur two to three times a week✓
- Each treatment lasts many hours✓
- Affects the quality of life of the patient✓
- Kidney machines are expensive to run and maintain✓
(Mark first TWO only) (Any 2)</td><td></td><td>(2)
(3)</td></tr>
<tr><td></td><td>8.2.6</td><td>R✓ - it’s the blood vessel entering the dialysis machine✓, so has the higher concentration of nitrogenous wastes✓
✓ - for the table</td><td></td><td></td></tr>
<tr><td></td><td>8.2.7</td><td><table><tr><th>Point A</th><th>Point B</th></tr><tr><td>• More urea, uric acid
• More water
• More salt</td><td>• Less urea, uric acid
• Less water
• Less salt</td></tr></table>(Mark first TWO only) Any 2 x 2</td><td></td><td>(5)
(2)</td></tr>
<tr><td></td><td>8.2.8</td><td>Both have the same amount of::</td><td></td><td></td></tr>
</table>

		- Glucose, amino acids, fat✓ - Oxygen and carbon dioxide✓		
				(22)

Activity 9

1. Definition of Excretion

Elimination of metabolic waste such as urea, uric acid and carbon dioxide from the body.

2. Excretory Organs

Organ	Product
2.1.skin	- sweat (urea, uric acid, salts, water)
2.2.lungs	- water and CO_2
2.3.kidneys	- urine (urea, uric acid, ammonia, water, salts, drugs, ions)

3. Four functions of the kidney

3.1 - osmoregulation - keeping constant water level

3.2 - excretion - eliminating nitrogenous waste eg. urea, uric acid

3.3 - salt level - keeping it constant

3.4 - pH regulation

4. Nephron : 3 processes

3.1 Bowmans capsule
- glomerular filtration

3.2 Proximal tubule
- tubular re-absorption

3.3 Distal tubule
- tubular excretion

5. Composition

5.1 of blood - blood cells, blood proteins, hormones, glucose, water, salts, amino acids, urea, uric acid, drugs, ions

5.2 of glomerular filtrate - water, glucose, amino acids, salts, urea, uric acid

5.3 of urine - water, urea, uric acid, ammonia, salts, drugs, ions

6. Differences between afferent and efferent arteriole

Afferent-arteriole	Efferent-arteriole
- wide diameter	- narrow diameter
- more urea, uric acid	- less urea, uric acid
- more glucose and oxygen	- less glucose and and oxygen
- less carbon dioxide	- more carbon dioxide

7. WHY?

7.1 Glucose in urine
- Excess glucose in blood
- thus excreted in urine
- due to shortage of insulin

7.2 No proteins in urine
- Proteins are large molecules
- that cannot filter through slit pores of Bowman's capsule
- and hence do not appear in the urine

7.3. More urea in urine than in glomerular filtrate
- Urea in urine obtained from two sources
- first : filtration from blood into glomerular filtrate
- second : from tubular excretion
- hence urea in urine is more than urea from glomerular filtrate

8. Adaptations of Malpighian Body

8.1 Diameter of afferent vessel greater than efferent vessel creating pressure for filtration

8.2 Pores on endothelium of glomerular capillaries - filtration

8.3 Large surface area of capillary network of glomerulus - increased filtration

8.4 Cup-shaped Bowmans capsule - allows greater contact with glomerulus for filtration

8.5 Slit-pore - of podocytes of Bowmans capsule - act as a selective filter

9. Adaptations of renal tubule

9.1 Long renal tubule - allows more time for excretion/re-absorption

9.2 Convoluted tubules - slows down fluid more thorough process of excretion and re-absorption

9.3 Second capillary network - around renal tubule allows for excretion and re-absorption

9.4 Sodium pump of Loop of Henle creates a gradient for water absorption

9.5 Microvilli of cuboidal cells of tubule - provide large surface area for re-absorption

9.6 Mitochondria of cuboidal cells - provide energy for re-absorption

Activity 10

10.1				
	10.1.1	The efferent vessel is narrower than the afferent vessel ✓ - Allowing a pressure system to develop which is essential for filtration. ✓ The contents of the Glomerulus are separated from the capsular space by a thin barrier✓ - made up of a single layer of endothelial cells of the capillary wall ✓ - and a single layer of podocytes✓ - which act as an ultra-fine filter The Bowman's capsule is cup shaped ✓ - allowing the blood capillaries of the glomerulus to fit closely into it✓ Podocytes in the inner wall of the Bowman's capsule✓ - have many small size slit pores✓ - ensures that the blood corpuscles and large plasma proteins✓ do not pass through the capsular space - and acts as a selective filter✓ The Glomerulus is convoluted✓		(6)

	10.1.2	- to increase surface area for maximum filtration to occur✓ - slows down the movement of the blood✓ - to allow maximum filtration to occur (Mark first THREE only) (Any 3 x 2) The renal tubules is long and convoluted✓ - to increase surface area for maximum absorption✓ - and slows down the movement of the filtrate✓ - allowing sufficient time for reabsorption of the useful substances✓ Cuboidal cells lining the tubules have microvilli✓ - to increase the surface area for maximum absorption✓ The cells of the tubule contain numerous microvilli✓ - to increase surface area for absorption✓ The secondary capillary network are in close contact with the tubules✓ - reduces the distance for reabsorption of useful substances✓ - and excretion of waste substances✓ - into the tubules✓ The “sodium pump” in the Loop of Henle✓ - ensures that the medulla has a high concentration of salts✓ - ensuring that large amounts of water can be		(6)

		reabsorbed ✓ - from the distal tubule and the collecting tubule✓ (Mark first THREE only) (Any 3 x 2)		
				(12)

10.2	10.2.1 10.2.2	No✓ - because animal is mostly immersed in water hence no water loss through sweating ✓ - less need for water conservation/ reabsorption✓ - by long tubule of Henlé✓ /water is not a limiting factor - therefore not as much need to conserve water as can drink more ✓ (1 + Any 2) Increase✓ - because a high ADH concentration increases water permeabilityof collecting ducts✓ - more water reabsorbed✓ - and ends up in the blood ✓ - thereby increasing blood volume ✓ - and thus the blood pressure✓ (1 + Any 2)		(3) (3)
				(6)

10.3		When the blood is too acidic / pH is too low - then more hydrogen ions✓ - are passed from the blood✓ - into the renal tubule✓ - and more bicarbonate ion✓ - are passed from the renal tubule to the blood ✓ - thus increasing the pH of the blood to normal✓ (Any 3) When the blood is too basic /alkaline / pH is too high - less hydrogen ions✓ - are passed from the blood into the renal tubule✓ - and less bicarbonate ions✓ - are passed from the renal tubule into the blood ✓ - thus decreasing the pH of the blood to normal✓ / more acidic (Any 3)		(3) (3)

B. Population Ecology

Activity 1

1.1				
	1.1.1	Social organisation✓	1	
	1.1.2	Simple sampling✓	1	
	1.1.3	Intra-specific✓	1	
	1.1.4	Resource partitioning✓	1	
	1.1.5	Commensalism✓	1	
	1.1.6	Mortality✓	1	
	1.1.7	Developing✓	1	
	1.1.8	Population✓	1	
	1.1.9	Natality✓	1	
	1.1.10	Territoriality✓	1	
	1.1.11	Culling ✓	1	
				11

Activity 2

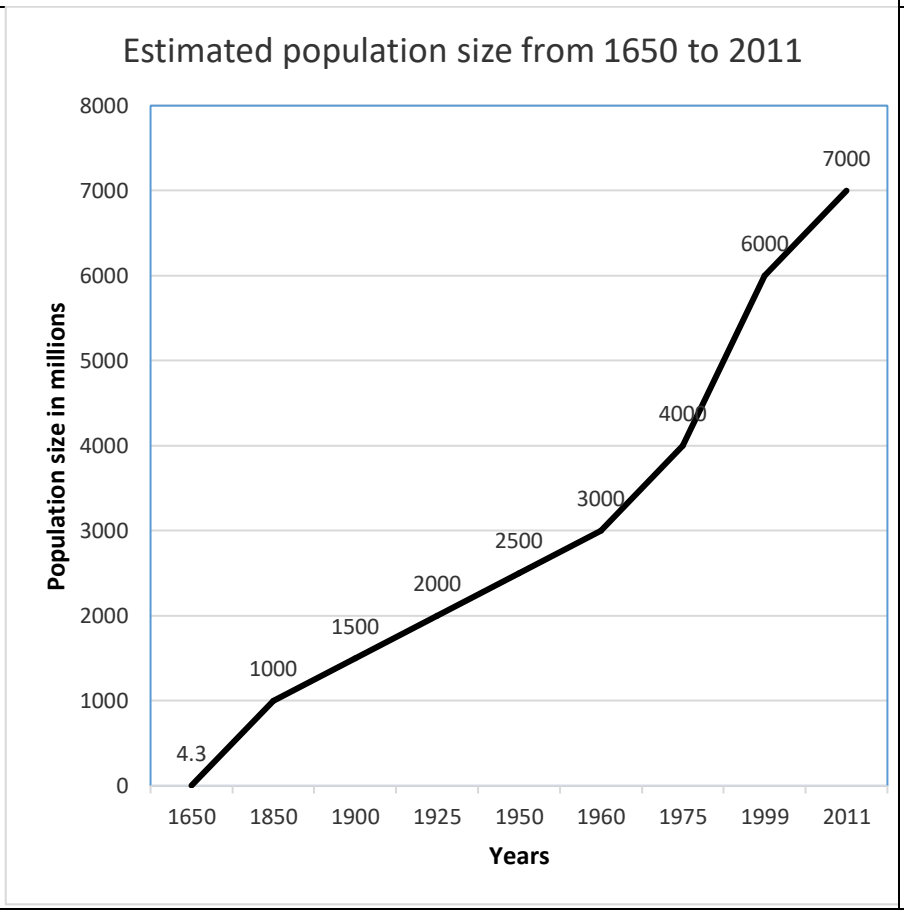
1.1				
	2.1.1	B✓✓	2	
	2.1.2	C✓✓	2	
	2.1.3	C✓✓	2	**6**

Activity 3

3.1				
	3.1.1	• Growth is rapid✓ • Due to the absence of limiting factors✓/presence of sufficient resources/absence of predators.	2	
	3.1.2	• Growth is slow✓	2	

		• Because the bacteria are still acclimatizing✓ to the new environment		
	3.1.3	Growth starts slowly and then increases rapidly✓	1	
	3.1.4	Humans are able to increase food production✓ using modern technology✓ OR Humans continue to clear natural vegetation✓ to create space for more homes✓	2	
	3.1.5	• Regulation of population growth by proper family planning✓ • Allocation of subsidies/incentives to people that have small families✓ • Educate the population on the need to limit family size✓ any 2	2	
				9

Activity 4

4.1				
	4.1.1			

		Criterion	**Mark**	6	
		Correct type of the graph	1		
		Caption – includes both variables	1		
		Correct label and unit for X- and Y- axis	1		
		Correct scale for X- axis and Y - axis	1		
		Plotting of points	1: 1 – 9 points plotted correctly 2: All 10 points plotted correctly		
	4.1.2	Geometric growth curve ✓		1	
	4.1.3	1850 – 1650 = 200 ✓ million years		1	
					8

Activity 5

4.1				
	5.1.1	- A series of progressive changes ✓ - In the composition of ecological community over time ✓	2	
	5.1.2	Primary ✓	1	
	5.1.3	- There is no soil ✓/ only exposed rocks found - The habitat is colonized by living organisms for the first time ✓	2	
	5.1.4	- Lichens ✓ - Mosses ✓	2	
	5.1.5	- They break down rock into soil ✓/ they help to form soil - thereby making it possible for other species to grow ✓	2	
				9

Activity 6

6.1				
	6.1.1	$P = \frac{M \times C}{R}$ ✓ **$P = \frac{500 \times 450}{5}$** ✓	3	

		P = 45 000 ✓		
	6.1.2	(a) Overestimate ✓ (b) Underestimate ✓	1 1	
				5

Activity 7

7.1				
	7.1.1	73%✓	1	
	7.1.2	- Planning for education✓ - Planning for health-care✓ - Planning for housing✓ **(Mark first TWO only)**	2	
	7.1.3	- There's been a decrease in income tax revenue✓ - Unemployment has increased✓ **(Mark first TWO only)**	2	
	7.1.4	- Since we would run out of resources✓ - future generations may have to pay more✓ - as we would be more dependent on imported products✓ **(Mark first ONE only)**	2	
				7

Activity 8

8.1						
	8.1.1	**Hummingbird**	Mutualism ✓✓	Bird receives nectar from the flower and pollinates the flower at the same time✓		
		Fleabite on human	Parasitism✓	Fleas bite the human and feed, and human is harmed in the process✓		
		Egret on rhino	Commensalism ✓	Egret benefits as it waits for the rhino to disturb insects in the grass as it moves along feeding. The		

				bird catches the insects as they fly up. The rhino is not harmed and does not benefit from the relationship✓	6	
						6

HUMAN IMPACT ON ENVIRONMENT

Terminology

1.	A process by which nutrients become highly concentrated in a body of water, leading to increased growth of organisms such as algae.	Eutophication
2.	Measurement of the total amount of carbon dioxide emissions of an individual, a defined population or a company per year.	Carbon footprint
3.	The type of pollution caused when water is released into a river after being heated in power stations or industries.	Thermal pollution
4.	A layer in the atmosphere that is damaged by chlorofluorocarbons (CFCs).	Ozone layer
5.	Measurement of the total amount of carbon dioxide emissions of an individual per year.	Carbon footprint
6.	Having access to enough food on a daily basis to ensure healthy living.	Food security
7.	The illegal removal of organisms from their habitat	Poaching
8.	The variety of plant and animal species on Earth	Biodiversity

Activity 1

1.1. - Respiration✓
- Decomposition✓
- Forest✓/Veld fires
(Mark first TWO only) Any 2 (2)

1.2 - Transport✓/diesel/coal/wood/liquid gas/paraffin
- Use of electrical appliances✓/refrigerators, stoves
(Mark first TWO only) Any 2 (2)

1.3 -Trees/plants absorb CO_2 ✓
- during photosynthesis✓ (2)

1.4 - More heat of sun is trapped✓/lesser heat escapes form earth surface
- consequently gradual rise in temperature✓
- causes the enhanced✓ greenhouse effect
(Mark first TWO only) (2)
(8)

Activity 2

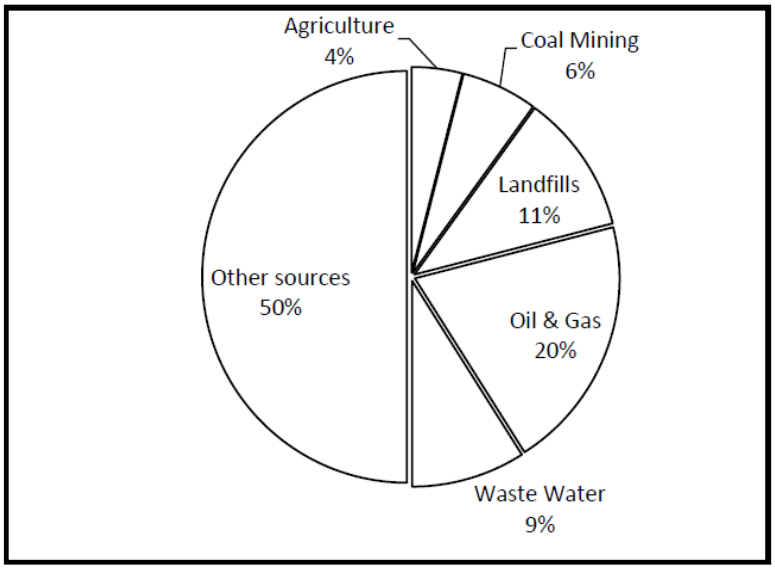
2.1 Global warming potential✓ 25 x more than that of CO_2 (1)

2.2 - decrease in mass✓ of organic waste through decomposition
- generate electricity✓ from methane formed (2)

Activity 3

3.1 (a) 4 + 6 + 11 + 20 + 9 = 50✓/(100 - 50) = 50✓ (2)

(b) **Estimated % Global Methane Emissions by different sources**



14

CALCULATIONS:

Agriculture	4/100 x 360 = 14.4°
Coal Mining	6/100 x 360 = 21.6°
Landfills	11/100 x 360 = 39.6°
Oil & Gas	20/100 x 360 = 72°
Water Water	9/100 x 360 = 32.4°
Other	50/100 x 360 = 180°

MARK ALLOCATION FOR THE PIE CHART	
Title of graph – both variables included	1
Draw the correct type of graph	1
1 – 5 Sectors correctly indicated/labelled 6 Sectors correctly indicated/labelled	1 2
1 – 5 sectors correctly calculated 6 Sectors correctly calculated	1 2

(6)

Activity 4

4.1.1 By implementing better farming techniques✓
irrigation✓
the application of fertiliser.✓ (Any2)

4.1.2 Drought ✓/ Erratic weather patterns (Any 1)

4.1.3 Irrigation is costly✓/irrigation is not practised
there is a lack of large river systems✓
(Mark first ONE only) (Any 1)

4.1.4 Fertilisers may be washed ✓into streams/rivers etc.
- resulting in excess nitrates✓/phosphates /eutrophication.
- causing an algal bloom✓
- which prevents light✓ from reaching the deeper layers of the river.
- This causes the plants to die ✓due to decreased photosynthesis✓.
- An increase in decomposition✓ results in less oxygen ✓ in the water.
- As a result the animals die as well✓. (Any 4)

Activity 5

5.1 As the temperature of the water increases/decreases✓ the concentration of the dissolved oxygen decreases/increases✓ (2)

5.2
- The higher temperature, results in water organisms and Bacteria becoming more active and using more oxygen✓
- resulting in an increase in the biological oxygen demand✓/
- Less oxygen available can lead to organisms dying✓ (2)

5.3 To increase✓ the validity✓ of the investigation. (2)

5.4 - A number of samples per site ✓ should have been taken.
- The average should have been calculated. (1)
(7)

Activity 6

6.1 a. Mayfly nymph✓
b. Sludge worms✓ (2)

6.2 The size/ volume of the water samples✓
Samples taken at the same depth✓
Samples taken at the same time
Use sterile containers **Max 2** (2)

6.3 Oxygen✓/ waste/ amount of substance **Mark first ONE only** (1)

6.4 The oxygen decreases✓ proportionally to the decrease in the waste✓ until the amount of waste reaches 'normal' levels✓ when the amount of oxygen begins to increase✓ and stabilise and become constant. ✓ (3)
Max 3

6.5 Unpolluted water/ less waste at X✓ therefore more plants will be present✓producing more oxygen through photosynthesis (✓)
Max 2

OR

Unpolluted water/ less waste at X✓ therefore fewer bacteria present✓ hence using less oxygen (✓) (2)
Max 2

6.6 Typhoid✓/ Cholera/ gastroenteritis (1)
Any 1

[11]

Activity 7

7.1 Advantages:

- Easy to deal with only requires land and transport✓
- It is the best way of disposing of toxic and dangerous waste✓
- Methane produced from landfills can be used as a source of energy✓ (3)

Disadvantages:

- Landfills cannot be situated too close to cities✓
- Land is expensive and fumes can affect people near by✓
- Cost of transporting waste to landfills✓
- Methane can be a fire hazard✓
- Methane contributes to global warming
- Run-off from rain can cause poisonous substances to seep into the soil

Max 4 (4)

Activity 8

8.1 Accept any answer between 29 - 31arbitrary units✓ (1)

8.2 (a) The sulphur dioxide level was higher in 2000 compared to 1995 in all countries✓ **OR**

The sulphur dioxide level was lower in 2005 compared to 2000 in most countries **OR**

The sulphur dioxide level was the same in most countries in 2000 (1)

(b) In France there was an increase in the level of sulphur dioxide from 2000 to 2005✓ whereas in all of the other countries there was a decrease from 2000 to 2005✓ (2)

8.3 Japan✓ (1)

8.4

- Using renewable sources of energy such as wind and solar energy✓/reducing use of fossil fuels
- Implementing programmes/strategies to save energy✓
- Improved/alternative technology to reduce pollution✓
- Improved legislation for air quality✓
- Effective monitoring✓
- Imposing heavy fines✓
- Make use of public transport/bicycles/hybrid cars✓
- Increased environmental awareness/education✓
- (It only has 50 arbitrary units of sulphur dioxide) ✓

(**Mark first TWO only**) (2)

(7)

Activity 9

9.1 Low number of species/low biodiversity✓ (1)

9.2 - Addition of phosphates caused eutrophication
- which led to an increase in algal growth / algal bloom✓
- which depleted the oxygen in the water ✓
- thus reducing its ability to support a variety of life-forms✓ **Any (3)** (3)

9.3 The length of food chains will be reduced✓/complexity of food webs will be reduced
- resulting in organisms feeding on the remaining species✓ having
- excess food✓- leading to their overpopulation✓
- while organisms depending on the species that were lost✓ will
- have less✓ /no food available
- leading to their death/migration **Any (4)** (4)

9.4 - The use of living organisms✓
- to control the numbers of other organisms✓ (2) **(10)**

Activity 10

10.1 420kg – 280✓ =140 ✓kg more✓ (1)

10.2 Variety of cotton planted/ boll resistant and original cotton types✓ (1)

10.3 To ensure that the increase in yield ✓was due to the cotton being resistant to boll weevil and not because of another factor (read sense of answer) ✓ (2)

10.4 A larger sample size ✓would have resulted in more reliable results✓ (2)

10.5 Boll weevil resistant cotton ✓will have a higher yield ✓in comparison to original variety ✓ when planted in the same conditions. (3)

10.6 The results show that the (percentage) yield✓ of boll weevil resistant✓ cotton is 10%✓ or more than the original variety when grown in the same conditions. (3)

10.7 Boll weevils do not feed on boll weevil resistant/R cotton✓ therefore less pesticide is needed than when using V cotton which they do eat ✓ (2)

10.8 Both (artificial and natural selection) ✓– farmers would choose to grow R cotton as it has a higher yield/ they use less pesticide, this is artificial selection ✓and because R cotton is less likely to be eaten therefore more will reproduce/ because there is a higher yield✓ more will be able to reproduce and over time there will be more R than V cotton ✓– natural selection (4)