KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 10-12 DIRECTORATE

NCS (CAPS)

TEACHER SUPPORT DOCUMENT

GRADE 11

LIFE SCIENCES

STEP AHEAD PROGRAMME

2023

PREAMBLE

This document has been prepared as support material for Grade 11 Life Sciences.

The material has been arranged in such a way that studying can be undertaken topic-wise. Within each topic, questions on the different sub-topics are arranged in the same sequence as that in the 2023 Amended Annual Teaching Plan (ATP).

This document takes the following into account:

- Focus on **core concepts and content** per topic as well as the relevant Life Sciences skills.
- Activity based Revision sessions and constant feedback on assessments/activities given.
- **Scaffolding of concepts** according to **cognitive/difficulty levels** and a differentiated approach to cater for learners with different abilities.
- Addressing the **Common errors & misconceptions** in each topic.
- Providing multiple opportunities for learners to master concepts through multiple exposure using different source stimuli.
- A focus on **scientific investigations** and **biological terminology** for each topic.
- Consolidating and supplementing topics through the use of previous examination question papers.

CONTENTS

Topic: Photosynthesis

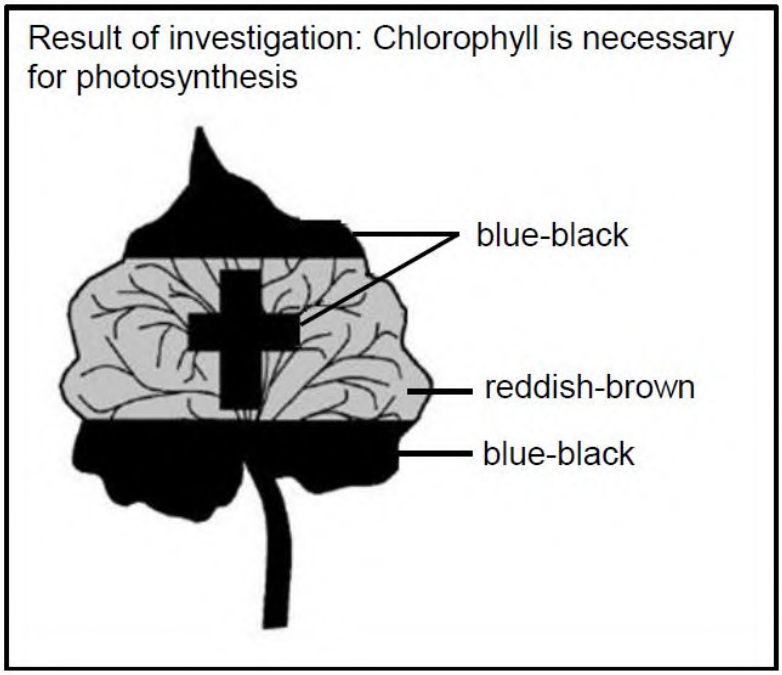
Activity 1

No.	Description	Biological Term
1.1	Chemical processes in organisms controlled by enzymes.	**Metabolism✓**
1.2	Organisms that cannot photosynthesise and obtain food from other organisms.	**Heterotrophic✓**
1.3	Building up chemical reactions.	**Anabolic✓**
1.4	Green plants that produce their own food through photosynthesis.	**Autotrophic✓**
1.5	Breaking down reactions.	**Catabolic✓**
1.6	The liquid part of the chloroplast where light independent phase takes place.	**Stroma✓**
1.7	The general energy carrier in the cells of living organisms.	**ATP✓**
1.8	A glass structure that traps heat and allows light to enter and plants to grow.	**Greenhouse✓**
1.9	Phenomenon where the heat from the sun is trapped on Earth by CO_2 in the atmosphere.	**Greenhouse effect✓**
1.10	Site of photosynthesis.	**Chloroplasts✓**
1.11	The form in which excess glucose is stored in plants.	**Starch✓**
1.12	A chemical used to test for starch.	**Iodine✓**
1.13	The organic molecules that act as catalysts and control the chemical reaction during photosynthesis.	**Enzymes✓**
1.14	Energy from the sun, needed by plants for photosynthesis.	**Radiant energy✓**
1.15	Stacks of thylakoids where light dependent phase takes place.	**Grana✓**
1.16	The simple sugar formed during photosynthesis in green plants.	**Glucose✓**
1.17	Stored form of glucose in animals.	**Glycogen✓**
1.18	Stored form of glucose in plants.	**Starch✓**
1.19	The green, light–trapping pigment in photosynthesis found in plant leaves.	**Chlorophyll✓**
1.20	The splitting of water molecules into hydrogen and oxygen in the presence of light.	**Photolysis✓**
1.21	The part of the chloroplast in which the light-independent reactions of photosynthesis take place.	**Stroma✓**
		(21 X1) **(21)**

Activity 2

2			
	2.1	Photosynthesis is the process by which plants produce carbohydrates (glucose) ✓using radiant energy from the sun ✓	(2)
	2.2	Chloroplast ✓	(1)
	2.3	(a) Dark phase ✓	(1)
		(b) Stroma ✓	(1)
	2.4	- Occurs in the grana of the chloroplast ✓ - chlorophyll molecules absorb radiant energy from the sun ✓ - this energy is used to split water into hydrogen and oxygen ✓ - and some energy is used to form ATP (energy-carrier) ✓ - energised hydrogen atoms are released and used in the dark phase ✓ - Oxygen is released into the atmosphere ✓	(6)
			(11)

Activity 3

3			
	3.1	To investigate whether light is necessary for photosynthesis ✓	(1)
	3.2	(a) To destarch the plant ✓	(1)
		(b) To soften the leaves/break the cell walls✓	(1)
		(c) To remove the chlorophyll✓	(1)
	3.3	Care should be taken when working with alcohol – no open flame to be brought near alcohol ✓as alcohol is highly flammable. ✓ OR Alcohol should be boiled using a water bath ✓ as alcohol is highly flammable. ✓	(2)
	3.4	 **Criterion** / **Marks** Correct caption: 1 Diagram with correct shading: 1 Any TWO correct labels: 2	(4)
	3.5	It can be concluded that light is required for starch ✓ to be produced during photosynthesis. ✓	(2)
			(12)

Activity 4

4			
	4.1	(a) A ✓ starch grain ✓	(2)
		(b) B ✓ grana ✓	(2)
		(c) C ✓ stroma	(2)
	4.2	- has sets of stacked membranes called grana✓ - Grana have thylakoids which contain chlorophyll✓ - Stroma has enzymes✓ - It has a double membrane✓ - Stroma contains starch granules✓ - Ribosomes are present in the stroma✓ (Any 2)	(2)
	4.3	- Removes carbon dioxide from the atmosphere✓ - which is used to form glucose✓ - Keeps the carbon dioxide concentration in the atmosphere fairly constant✓ for the survival of animals - Produces glucose and other energy-rich compounds✓ that provide a source of food and energy to plants and animals	(4)
			(12)

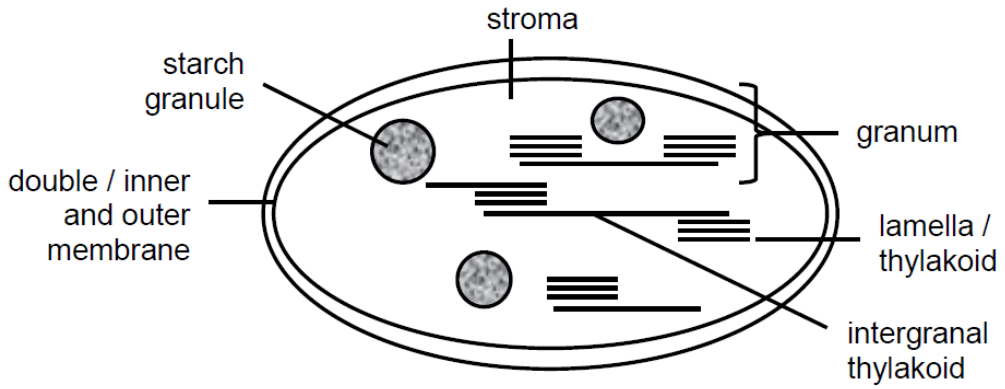
Activity 5

5			
	5.1	The light intensity ✓	(1)
	5.2	By counting the number of bubbles released per minute ✓✓	(2)
	5.3	(a) Oxygen ✓	(1)
		(b) The glowing splint ✓ burst into flame / glows brighter which indicates that oxygen has been given off ✓ by the plant.	(2)
	5.4	To increase the concentration of carbon dioxide in the water ✓	(2)
	5.5	- Temperature ✓ - The voltage of the bulb ✓/ current - The amount of carbon dioxide ✓ - Person counting the bubbles ✓ - Plant species ✓ - The surface tension of water ✓ - The purity of water used ✓ **(Mark the first TWO only)** (Any 2)	(2)
	5.6	(a) $28 - 8 = 20$ ✓ $\frac{20}{8} \times 100$ ✓ $= 250$ ✓%	(3)
		(b) -It enables farmer to adjust the light to its optimal level ✓ - in order to increase the rate of photosynthesis ✓ - By increasing the rate of photosynthesis, the farmer is able to increase agricultural yield to its maximum ✓	(3)
			16

Activity 6

6			
	6.1	- Occurs in the stroma of the chloroplast ✓ - Carbon dioxide from the atmosphere combines with energised - hydrogen atoms ✓ - to form carbohydrates such as glucose and starch✓ - using energy in the form of ATP from the light phase. ✓	(4)
	6.2	- No food (energy) available ✓for heterotrophic organisms✓ - There won't be energy available✓ for cell functioning✓ - Imbalance of CO_2 in the atmosphere✓ can influence breathing✓ - and less oxygen✓ for cellular respiration ✓ (Any 3 X 2)	(6)

Activity 7

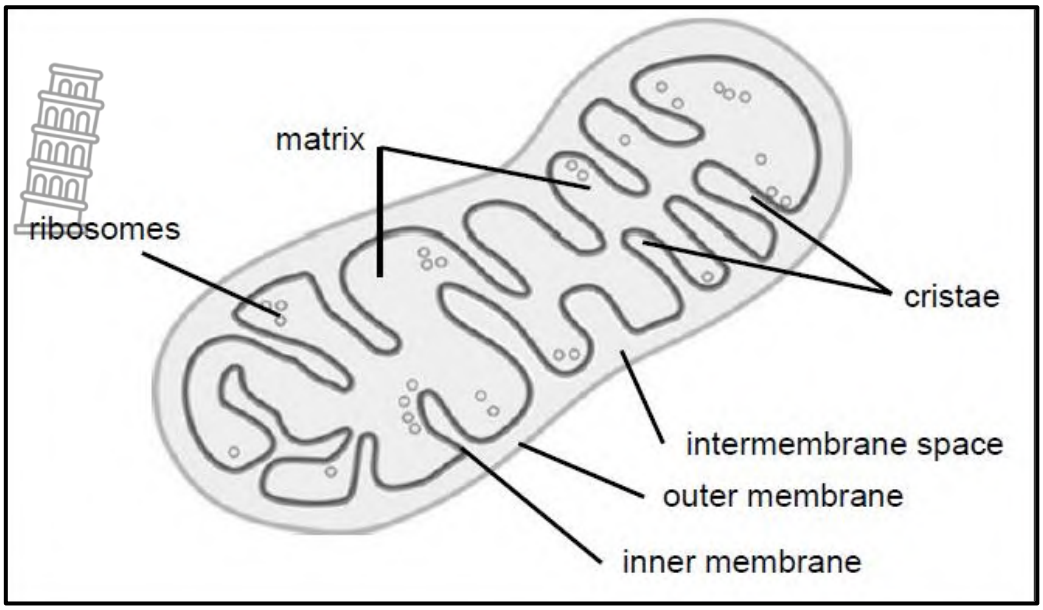
7			
	7.1	 Diagram showing the structure of a chloroplast **Criterion** / **Marks** Caption: 1 Correct diagram: 1 Any other TWO correct labels: 1 per label up to 2	(4)

Topic: Cellular Respiration

Activity 1

No.	Description	Biological Term
1.1	Respiration in the presence of oxygen	**Aerobic respiration✓**
1.2	Organelle / site for respiration	**Mitochondria✓**
1.3	The process where a plant grows from a seed	**Germination✓**
1.4	Acid formed in muscle cells, during anaerobic respiration; leads to muscle exhaustion / cramping	**Lactic acid✓**
1.5	The reagent used to test for the presence of carbon dioxide.	**Clear lime water✓**
1.6	breaking down of glucose in absence of oxygen, to give rise to the production of alcohol in plant cells	**Alcohol fermentation✓**
1.7	The process during which glucose is converted into pyruvic acid	**Glycolysis✓**
1.8	Breaking down of glucose in absence of oxygen to form lactic acid in animal cells	**Lactic Acid fermentation✓**
1.9	Type of anaerobic respiration in yeast (and other) cells	**Fermentation✓**
1.10	The final hydrogen acceptor during cellular respiration	**Oxygen✓**
1.11	Folded structures found on the inner membrane of a mitochondria.	**Cristae✓**
1.12	Genetic material found in the mitochondrial matrix.	**Mitochondrial DNA✓**
1.13	The stage during aerobic respiration when water is released as a waste product.	**Oxidative phosphorylation✓**
1.14	A 6-carbon molecule that is broken down during cellular respiration to provide energy in a living cell	**Glucose✓**
1.15.	A micro-organism used in the manufacturing beer or bread	**Yeast✓**
		(15 X 1) **(15)**

Activity 2

2			
	2.1		(4)

Criterion	Marks
Caption	1
Correct diagram	1
Any other TWO correct labels	1 per label up to 2

Activity 3

3			
	3.1.	Mitochondrion ✓	(1)
	3.2.	B – Stroma✓ C – Cristae ✓	(2)
	3.3.	(a) A✓ Ribosomes✓	(2)
		(b) B✓ Stroma✓	(2)
			(7)

Activity 4

4			
	4.1	Cheese, yoghurt, wine, beer, whisky, brandy (any other relevant products) ✓ (Mark first answer only)	(1)
	4.2	- Products are exported ✓ and earns foreign exchange ✓ - Jobs are created ✓ and reduces unemployment✓ - Company profit increases✓ and government earns more revenue as taxes✓ (Any 1 X 2)	(2)
	4.3	Derives energy✓ for cellular activities✓	(2)
			(5)

Activity 5

5			
	5.1	To prevent air from entering the test tubes ✓as it would alter the experimental results / to stop gases from entering or leaving.	(1)
	5.2	- Test tube B contains a bag of live worms ✓ - They produce large amounts of carbon dioxide over time. ✓ / during - cellular respiration which causes the indicator in test tube B to become yellow✓	(2)
	5.3	Test tube C was set up as a control ✓/ to compare results✓ / to determine whether the factor under investigation was actually the one that caused the change✓	(1)
	5.4	- No photosynthesis will take place ✓ due to lack of light. - the green leaves continue to respire ✓ at a rate slower than animals - hence releases small amounts of carbon dioxide ✓ and later - the amount of carbon dioxide increases ✓ due to gradual accumulation. (Any 3 x 1)	(3)

Activity 6

6			
	6.1	(a) Anaerobic respiration ✓/ lactic acid fermentation	(1)
		(b) In the skeletal muscles ✓	(1)
	6.2	18/19 ✓arbitrary units	(1)
	6.3	10 ✓ minutes	(1)
	6.4	- The intense physical activity leads to an increased rate of cellular respiration ✓ - causing an accumulation of carbon dioxide ✓ and - decrease in the level of available oxygen ✓ due to insufficient ventilation - therefore, only glycolysis takes place ✓ - In the absence of sufficient oxygen, the pyruvic acid molecules are converted to lactic acid ✓ which is stored in the muscle tissues. (Any 4 x 1)	(4)
	6.5.	- No physical activity occurs during resting ✓ - less glucose is required to be oxidised ✓ - therefore, the demand for oxygen is decreased ✓/ excess carbon dioxide is expelled from the body gradually✓ / carbon dioxide-oxygen balance will be restored. - lactic acid stored in the muscles will be converted back to pyruvic acid✓ - enabling the cell to complete the process ✓ / Krebs cycle and oxidative phosphorylation (Any 4 x 1)	(4)
			(12)

Activity 7

7			
	7.1	(a) Occurs in the cytosol ✓ Glucose is broken down ✓ To form pyruvic acid ✓ Releasing energised hydrogen and ATP ✓	(4)
		(b) Occurs in the mitochondria ✓ In the presence of Oxygen ✓ Pyruvic acid produced during glycolysis ✓ Is used in a cyclic series of reactions ✓ Energised hydrogen atoms are released ✓ CO_2 is released into the atmosphere ✓ (Any 4)	(4)
			(8)

Activity 8

8			
	8.1	(a) Glucose ✓	(1)
		(b) - Energy/ATP✓ - Carbon dioxide ✓ - Water ✓ (Any 2)	(2)
	8.2	Aerobic respiration occurs in the presence of oxygen ✓and anaerobic respiration take place in the absence of oxygen. ✓	(2)
	8.3	- Alcohol ✓ - Carbon dioxide ✓ - ATP/energy ✓ (Any 1)	(1)
			(6)

Activity 9

9			
	9.1	T✓	

Aerobic respiration	Anaerobic respiration
1. Occurs in the presence of Oxygen ✓	1. Occurs in the absence of Oxygen ✓
2. Products are CO_2 and H_2O✓	2. Products are lactic acid (animals) or CO_2 and ethanol (plants and yeast cells) ✓
3. Large amount of energy is released (38 ATP) ✓	3. Small amount of energy is released (2 ATP) ✓
4. Occurs in the cytosol and inside the mitochondria ✓	4. Only occurs in the cytosol ✓

(1 + Any 2 X 2) **(5)**

Topic: Animal Nutrition

Activity 1

No.	Description	Biological Term
1.1	The type of organisms that consume only plant matter	**Herbivore✓**
1.2	The type of teeth responsible for piercing into food and grasping/ holding onto food in a meat based diet	**Canines✓**
1.3	Intake of food	**Ingestion✓**
1.4	Physical and chemical breakdown of food into its simplest form	**Digestion✓**
1.5	The removal of undigested and unabsorbed waste from the body through the anus in the form of faeces	**Egestion✓**
1.6	The products of digestion diffuse into the blood stream	**Absorption✓**
1.7	Nutrients such as amino acids are incorporated into the cells	**Assimilation✓**
1.8	An automatic wave of muscle contraction and relaxation that moves food in one direction through the digestive tract	**Peristalsis✓**
1.9	A ball-like mixture of food and saliva that forms in the mouth during the process of chewing	**Bolus✓**
1.10	Is a fluid produced by the liver, and stored in the gall bladder, that aids the digestion of lipids in the small intestine	**Bile✓**
1.11	A semi-liquid mass of partially digested food which has gone through mechanical and chemical digestive processes while passing through the stomach into the duodenum	**Chyme✓**
1.12	Tiny finger-like projections lining the wall of the small intestine and increasing the surface area for food absorption	**Villi✓**
1.13	The ability of an organism to maintain stability of internal conditions (e.g. temperature, chemical balance) despite changes in its environment	**Homeostasis✓**
1.14	A gland that uses ducts to drain and transport secretions or chemicals out of the body or onto body surfaces	**Exocrine✓**
1.15	An organ that secretes hormones directly into the blood stream or lymphatic system instead of through ducts	**Endocrine✓**
1.16	The disease experience by humans when glucose levels are not being homeostatically maintained	**Diabetes✓**
		(16 X 1) **(16)**

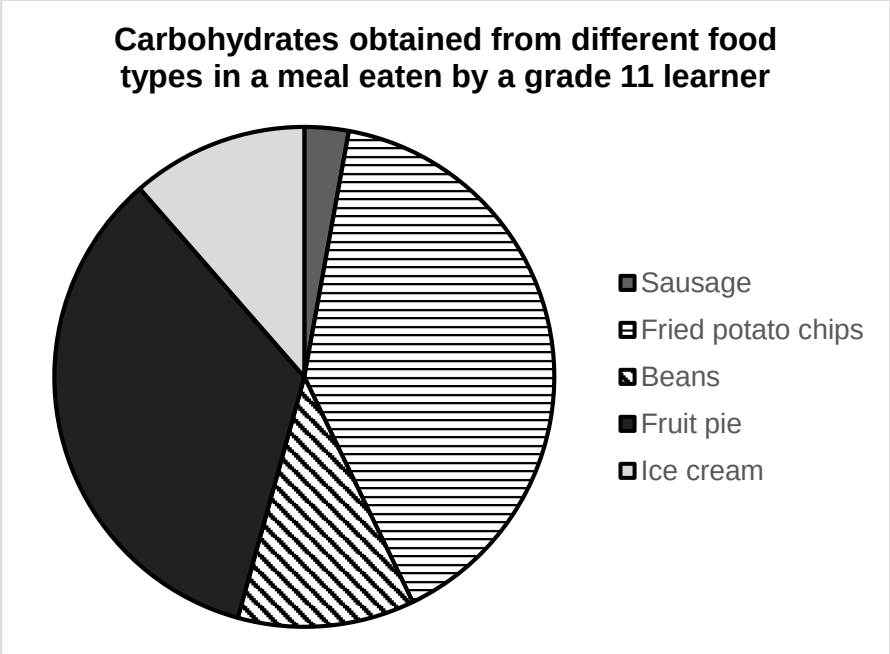
Activity 2

2.1			
	2.1	A ✓	(1)
	2.2	- Large pointed canines ✓ - Molars and premolars are also pointed / jiggered ✓ - Small diastema ✓ (Any 2)	(2)
	2.3	(a) Incisors ✓ 8 ✓	(2)
		(b) 32 ✓	(1)
		(c) They do not have canines ✓ which are used for tearing meat ✓	(2)
			(8)

Activity 3

3			
	3.1	Pure vegetarian✓	(1)
	3.2	140 000✓ kJ✓	(2)
	3.3	- Young children grow rapidly✓ - is difficult for them to consume enough vegetarian/ bulk food✓ - insufficient nutrients/ proteins/ carbohydrates/ vitamins/ mineral✓ - causes malnutrition/ kwashiorkor/ marasmus✓ (Any 2)	(2)
	3.4	10 000/ 40 000✓ X 100✓ = 25%✓	(3)
	3.5	- Plants/ parts of plants✓ - Specific name of plants/ supplements/ tablets✓	(1)
			(9)

Activity 4

4			
	4.1	Ice cream ✓	(1)
	4.2	5 000/ 15 000✓ X 100✓ = 33%✓.	(3)
	4.3	- They would become obese/ overweight✓ - due to excess nutrients/ energy✓ / if not exercising✓	(2)
	4.4	- Carbohydrates✓ - Fats✓	(2)
	4.5		

Criterion	Mark
Type of graph	1
Title	1
Calculations	2 marks: All correct
	1 mark: 1-3 correct
Accuracy of sector sizes	2 marks: All correct
	1 mark: 1-3 correct

(6)

			(14)

Activity 5

5			
	5.1	B - Oesophagus ✓ D - Small intestine ✓ E - Large intestine ✓ G - Rectum ✓ I - Liver ✓	(5)
	5.2	(a) A ✓ mouth✓	(2)
		(b) C ✓ stomach ✓	(2)
		(c) F ✓ anus ✓	(2)
	5.3	- Tongue ✓ - moves the food around during chewing thus mixing food with saliva ✓ - and helps to form the bolus for swallowing ✓	(3)
			(14)

Activity 6

6			
	6.1	B - Stomach ✓ C - Pancreas ✓ D - Small intestine ✓ G - Gall bladder ✓	(4)
	6.2	(a) H ✓	(1)
		(b) B ✓	(1)
		(c) F ✓	(1)
	6.3	Presence of smooth muscles ✓* on its walls allow for peristaltic contractions - that physically break down ✓ large food material into smaller pieces - and this mixes food with digestive juices ✓ (1* + Any 1)	(2)
	6.4	- The liver secretes bile ✓ - Bile is stored in the gall bladder ✓ - and is released via bile duct ✓ - to the duodenum ✓ - Bile emulsify fat ✓ / breaks up fat globules into droplets - Bile salts make fatty acids ✓/ glycerol - more soluble in water ✓ - Enzymes now have a larger surface area to break down fats ✓ (Any 5)	(5)
			(14)

Activity 7

7			
	7.1	- Glycerol & fatty acids combined with bile salts✓ - absorbed into the lacteal by diffusion✓	(2)
	7.2	- Produces mucous✓ - to keep intestinal wall moist✓ / assist in movement of food over villus✓	(2)
	7.3	- Villus is finger-like✓ projection/ elongated shape, which provides a large surface area for maximum absorption✓ - Transport system present✓/ lacteal & capillary network, to transport absorbed nutrients away from the intestine✓ - Single layer of columnar epithelium lines the villus✓, providing a thin surface for the diffusion of nutrients✓ - Columnar epithelium have microvilli✓, increasing surface area for absorption✓ **(Mark the first TWO only)** (Any 2 X 2)	(4)
	7.4	- Y contains high concentration of nutrients ✓ (glucose/ amino acids) - X contains a low concentration of nutrients✓ (glucose/ amino acids)	(2)
	7.5	- Through hepatic portal vein✓ to liver - then hepatic vein✓ - to heart✓ & rest of body	(3)
			(13)

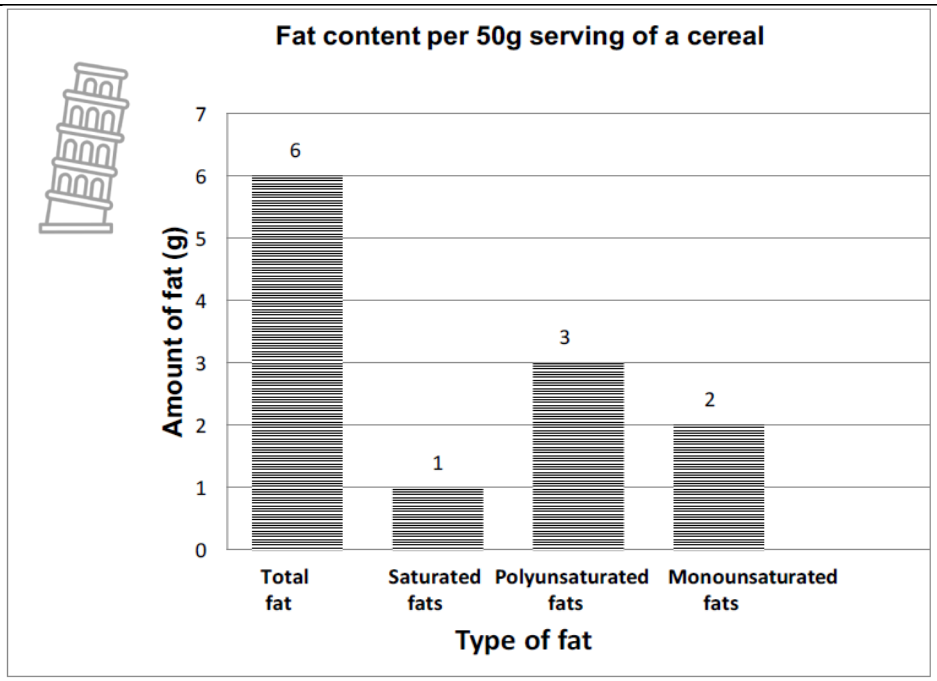
Activity 8

8			
	8.1	Villus✓	(1)
	8.2	(a) (Ciliated) columnar epithelium ✓	(1)
		(b) Lacteal✓ vessel	(1)
	8.3	Small intestine✓	(1)
	8.4	- It is long✓, meaning that it has a very large surface area for absorption✓ - It has many folds ✓ that enlarge the surface area for maximum absorption of nutrients✓ - Has many/ 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)
	8.5	C✓	(1)
	8.6	- The blood flows in at D ✓ to the capillary network - 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 9

9			
	9.1	- 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)
	9.2	Kwashiorkor✓	(1)
	9.3	- Gastric glands✓ in the stomach - secrete gastric juices✓ - that contain enzyme proteases✓ - that hydrolyse/ digest proteins✓ - into polypetides/ peptones✓ - and eventually amino acids. ✓ - Protease function best in an acidic medium. ✓ (Any 5)	(5)
			(8)

Activity 10

10			
	10.1	7530kJ ÷ 746kJ✓ = 10✓	(2)
			

Criterion	Mark
Type of graph	1
Title	1
Labels on x axis and y axis with units	1
Scale of x axis (equal width and spacing of bars) and y axis	1
Drawing of bars	2 marks: All correct 1 mark: - 1 to 3 correct

(6)

	10.3	- Gastric glands in the stomach ✓ - secretes gastric juices✓ which - contains the enzyme proteases. ✓ - The enzyme proteases hydrolyse/digest ✓ - proteins into polypeptides/peptones ✓ - and eventually into amino acids. ✓ - Protease only function best in an acidic medium. ✓ (Any 5)	(5)
			(13)

Activity 11

11			
	11.1	To determine the time taken to form chyme when egg is prepared/ cooked differently✓✓	(2)
	11.2	(a) Substrate/ condition of egg✓	(1)
		(b) Time taken for the formation of chyme✓	(1)
	11.3	- To create a similar condition to that of the body✓ OR - It is the optimum body temperature✓	(1)
	11.4	Mass/ amount (50g) of sample ✓	(1)
	11.5	(a) Fried eggs ✓	(1)
		(b) Scrambled eggs ✓	(1)
	11.6	- Stomach is faster/ test tube is slower✓ - due to churning of stomach✓	(2)
	11.7	(a) - Glucose ✓ from - small intestine✓ moves - by active transport✓ - which requires energy✓ - and by diffusion✓ - that is passive/ no energy required✓ - through columnar epithelial cells✓ - into the blood capillaries✓ - of the villus✓ (Any 4)	(4)
		(b) - The blood capillaries in the villi join together✓ - and eventually form the hepatic portal vein✓ - This blood vessel carries the product to the liver✓ - Some may be converted to glycogen/ some may be processed✓ - Remainder leaves liver in hepatic vein✓ - that joins with the inferior vena cava✓ - which takes blood to the heart✓ - The heart pumps the blood with nutrients/ glucose to body✓ - via the aorta✓ (Any 4)	(4)
			(18)

Activity 12

12			
	12.1	300 mg / dL ✓	(1)
	12.2	(a) 2 hours 30 minutes / 150 minutes ✓✓	(2)
		(b) 3 hours 30 minutes / 210 minutes ✓✓	(2)
	12.3	- Regular in-jections of insulin would lower the blood glucose concentration of the diabetic to normal. ✓ OR - It will also shorten the time it takes for the blood glucose concentration to return to normal after ingestion. ✓	(1)
	12.4	-To reduce the blood glucose levels ✓ OR -To convert glucose into glycogen ✓	(1)
	12.5	- Insulin is a protein and therefore digested in the human digestive system. ✓ - It would therefore not be absorbed as insulin, but as its amino acids. ✓	(2)
			(9)

Activity 13

13			
	13.1	The level increases✓	(1)
	13.2	T✓	(5)

Fewer larger meals	More smaller meals
1. Maximum blood insulin concentration is higher✓/between 160-180 mg/dl	1. Maximum blood insulin concentration is lower✓/between 120-140 mg/dl
2. Minimum blood insulin concentration is lower✓/between 20-30 mg/dl	2. Minimum blood insulin concentration is higher✓/40 mg/dl
3. Blood insulin concentration rises and falls three times a day✓/less often	3. Blood insulin concentration rises and falls six times a day✓/more often
4. Large changes in insulin concentration✓/between 140-160 mg/dl	4. Small changes in insulin concentration✓/between 80-100 mg/dl
5. Insulin concentration drops below minimum glucose concentration✓	5. Insulin concentration varies above and below minimum glucose concentration✓

(1 + Any 2 X 2)

	13.3	- A diabetic may not produce sufficient insulin✓ - When eating many smaller meals, less glucose✓ enters the blood - less insulin✓ is needed - to return blood glucose to normal✓ OR - A diabetic may not produce sufficient insulin✓ - When eating fewer larger meals, more glucose✓ enters the blood - more insulin✓ is needed - to return blood glucose to normal✓	(4)
			(10)

Activity 14

14			
	14.1	(a) Pancreas✓	(1)
		(b) Insulin✓	(1)
		(c) Glucagon✓	(1)
	14.2	Diabetes✓ mellitus	(1)
	14.3	- Pancreas is stimulated✓ - secretes insulin✓ - transported by blood to liver✓ - that is stimulated to convert excess glucose✓ - to glycogen✓ - which is then stored✓ - insulin increases rate of glucose absorption/ uptake✓ - in body/ muscle cells✓ (Any 6)	(6)
	14.4	- When glucose level is low✓ - Glucagon/ Hormone 3 travels via the blood✓ - to stimulate the liver✓ - which then converts stored glycogen✓ - into glucose✓ (Any 4)	(4)
			(14)

Topic: Gaseous Exchange

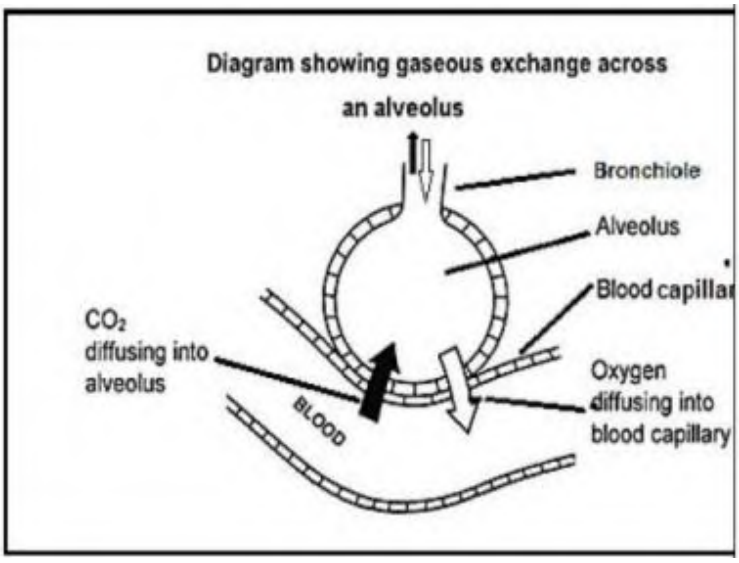
Activity 1

No.	Description	Biological Term
1.1	A cartilaginous flap that closes the trachea when swallowing to prevent choking.	**Epiglottis✓**
1.2	Taking in of oxygen-rich air into the lungs.	**Inhalation✓**
1.3	Taking out of air rich in carbon dioxide from the lungs.	**Exhalation✓**
1.4	Two membranes surround the lungs.	**Pleura✓**
1.5	A flap of breathing muscle that separates the chest cavity from the abdominal cavity.	**Diaphragm✓**
1.6	Breathing in of oxygen- rich air and breathing out of air rich in carbon dioxide.	**Ventilation✓**
1.7	Air sac membrane from the bronchiole in the lungs.	**Alveolus✓**
1.8	The form in which carbon dioxide is carried by blood away from tissues.	**Carboxy-haemoglobin✓**
1.9	The form in which oxygen is carried by blood to the tissues.	**Oxyhaemoglobin✓**
1.10	A system in which the body maintains normal limits of oxygen by blood in the body.	**Homeostasis✓**
1.11	The blood cells that transport oxygen.	**Erythrocytes✓**
1.12	The cartilaginous structure that contains vocal cords.	**Larynx✓**
1.13	The region of the brain that controls the rate of breathing in humans.	**Medulla oblongata✓**
1.14	The structure in the human respiratory system that closes the larynx.	**Epiglottis✓**
		(14 x 1) **(14)**

Activity 2

2			
	2.1	(a) Both processes involve movement/in and/or out of gases/oxygen and carbon dioxide✓	(1)
		(b) **Breathing** - Is concerned with the movement of air between the lungs and the atmosphere✓ **Gaseous exchange** - Is concerned with movement of gases between alveoli and blood/blood and cells✓	(2)
	2.2	- The external intercostal muscles relax✓ - Causing the ribs to move downwards and inwards✓ - The diaphragm relaxes✓ and become dome-shaped✓ - The volume of the thoracic cavity is decreased✓ - The abdominal muscles contract✓ and force the abdominal content upwards against the diaphragm - The pressure in the thoracic cavity and lungs increase✓ - The elastic lungs are compressed ✓ - Air pressure in the lungs is higher than in the atmosphere✓ - Air rich with carbon dioxide (CO_2) flows out of the lungs✓ (Any 6)	(6)
			(13)

Activity 3

3			
	3.1	A - Trachea✓ B - lung✓ C - diaphragm✓ D - intercostal muscles✓	(1) (1) (1) (1)
	3.2	- Has (C-shaped) cartilaginous rings✓ that keep the trachea open✓ at all times to allow free flow of air. - Has cilia✓ that 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)
	3.3	- Lung inflates✓ / enlarges✓ / volume increases✓ / pressure decreases✓ - Diaphragm flattens✓ becomes less convex✓ / contracts✓	(2)
	3.4		
			(5)
			(13)

Criterion	Marks
Diagram	1
Oxygen diffusion into blood	1
Carbon dioxide diffusion out of blood	1
Any other TWO correct labels	1 per label up to 2

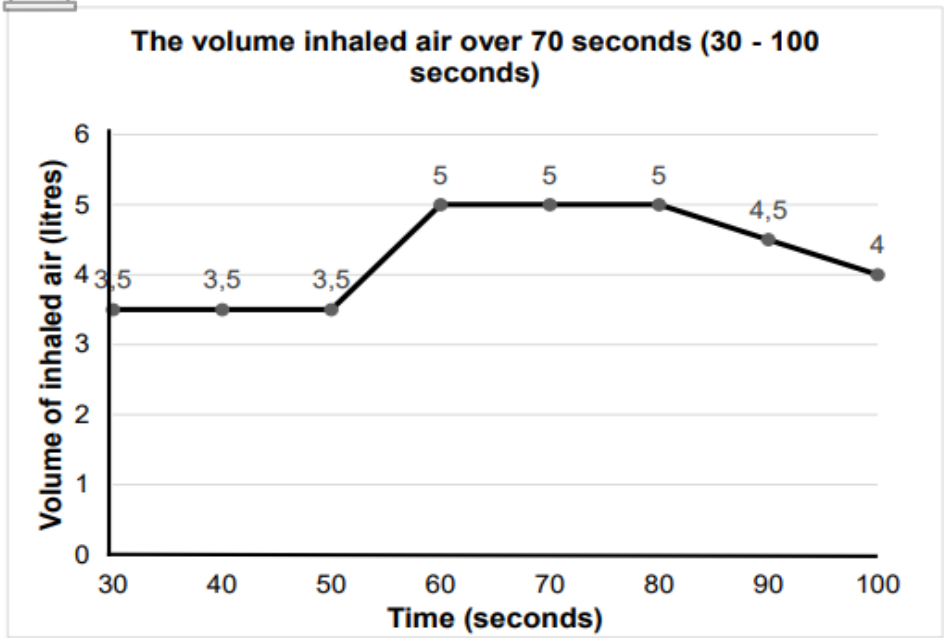
Activity 4

4			
	4.1	(a) Larynx ✓	(1)
		(b) Trachea ✓	(1)
		(c) Bronchioles ✓	(1)
	4.2	Process 2✓	(1)
	4.3	- 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)
	4.4	D✓ - intercostal muscle✓ E✓ - diaphragm✓	(4)
	4.5	- 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 ✓/ gasses can only diffuse in a solution✓.	(4)
	4.6	- Cannot breathe/ inhale/exhale/lungs collapse ✓ - No pressure difference between exterior and thoracic cavity ✓	(2)
	4.7	- 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.	(3)
			(19)

Activity 5

5			
	5.1	(a) bronchus✓ /bronchiole✓	(1)
		(b) Gaseous exchange✓ /diffusion✓	(1)
	5.2	(a) Carbon dioxide✓	(1)
		(b) Oxygen✓	(1)
	5.3	-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)
	5.4	-In the cells at tissue surfaces, the process of cellular respiration takes place✓ -More carbon dioxide (CO_2) is released during the process and move out of the cells as it is highly concentrated✓ -via the tissue fluid ✓ -into the blood capillaries around the tissue cells✓ where it is less concentrated✓ -and is transported away from the tissues✓. (Any 4)	(4)
	5.5	- Bicarbonate ions✓ - carboxyhaemoglobin✓ - blood plasma✓ (Any 2)	(2)
			(12)

Activity 6

6			
	6.1	- The volume of air inhaled will be less from the beginning✓ - because of the narrowing of the of the air passages. ✓	(2)
	6.2	20✓ seconds✓	(2)
	6.3	- The volume of air increased✓ from 60 to 80 seconds - to supply the muscles enough oxygen✓and - remove the excess carbon dioxide✓ (Any 2)	(2)
	6.4		(6)
			(12)

Criterion	Marks
Line graph is drawn	1
Title of the graph	1
Correct scale for x-axis and y-axis	1
Correct labels and units for the x-axis and y-axis	1
Plotting of the points: 0 points correct 1 - 4 points correct 5 - 7 points correct	0 1 2

Activity 7

7			
	7.1	(a) Wearing of a facemask✓	(1)
		(b) Carbon dioxide levels in blood✓	(1)
	7.2	- Age✓ - Healthy✓ individuals **(Mark first TWO only)**	(2)
	7.3	150 volunteers were used✓ **(Mark first ONE only)**	(1)
	7.4	-To allow the carbon dioxide levels in the blood to go back to normal✓ - so that each phase will have the same carbon dioxide level as a starting point✓	(2)
	7.5	-To act as a control✓/ baseline -To see if it is the facemask that affects the carbon dioxide levels and not the physical activity✓ (Any 1)	(1)
	7.6	- Receptors in the carotid artery are stimulated✓ and - impulses are sent to the medulla oblongata✓ - The medulla oblongata stimulates the heart✓ causing - to beat faster✓ causing - more carbon dioxide to be taken to the lungs✓ - The breathing muscles✓ /intercostal muscles and diaphragm - contract more actively✓ and - the rate/ depth of breathing increases✓ - More carbon dioxide is exhaled✓ - The carbon dioxide level in the blood decreases✓ /returns to normal (Any 7)	(7)
			(15)

Activity 8

8			
	8.1	Physical activity✓	(1)
	8.2	- Asked learners' permission✓ - Decided on the type of physical activities✓ - Decided how to measure the heart rate and breathing rate✓ - Decided on how to record the result of the investigation✓ - Decided the venue✓ **(Mark first TWO only)** (Any 2)	(2)
	8.3	- learners are same age✓ - learners walked same distance✓/ 5km - learners ran same distance✓/ 5km **(Mark first ONE only)** (Any 1)	(1)
	8.4	The learners' breathing rate increased✓	(1)
	8.5	Enables more carbon dioxide to be removed out of the body quickly/ exhaled ✓✓	(2)
	8.6	120 - 71✓ = 49 beats per minute✓	(2)
	8.7	Physical activities increase heart rate and breathing rate✓✓	(2)
			(11)

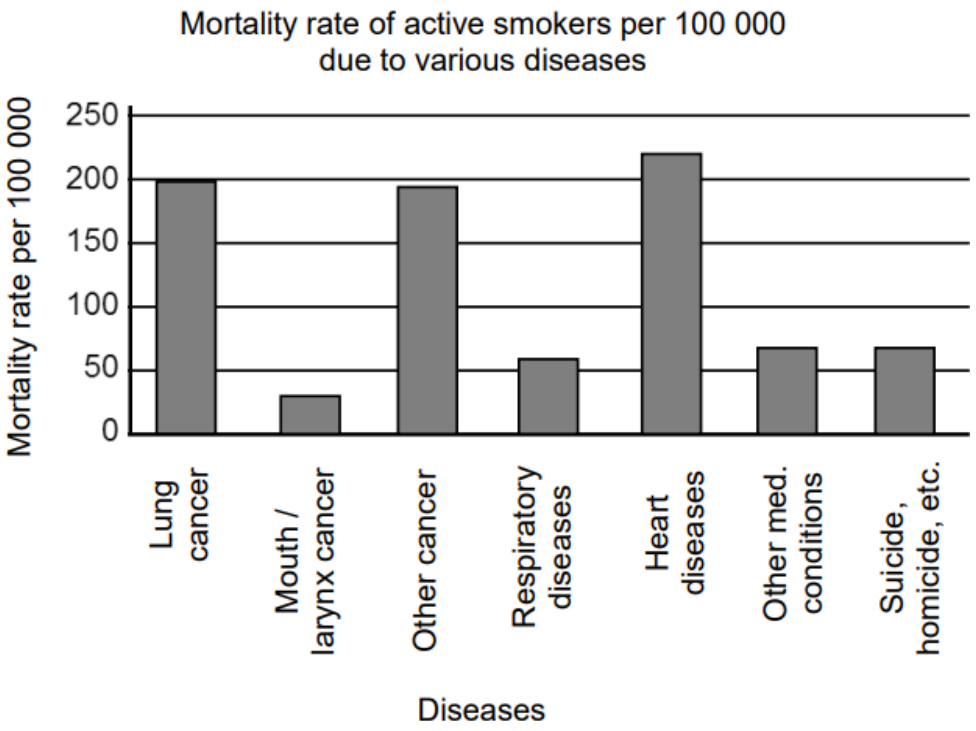
Activity 9

9			
	9.1	The red blood cell count increases✓ at altitude; haemoglobin concentration increases✓ at altitude	(2)
	9.2	Erythrocytes✓	(1)
	9.3	Transport of oxygen✓	(1)
	9.4	Iron (Fe) ✓	(1)
	9.5	5,37- 4,69✓ = 0,68÷4,69 x 100✓ = 14,5%✓	(3)
	9.6	RBC (mill/mm3) OR Haemoglobin (g/dl) ✓	(1)
	9.7	Their increased number of RBC and haemoglobin will enable them to carry more oxygen✓ and then improve their performance✓	(2)
	9.8	Males and females✓ were used in the experiment and this could influence the validity of the results obtained✓	(2)
			(13)

Activity 10

10			
	10.1	It becomes more deeper✓/depth is increased	(1)
	10.2	200cm^3✓/60✓ =3,3cm^3✓	(3)
	10.3	-There is high amount of CO_2 in blood just after an exercise✓ -which the man sheds away as he breathes in and out deeply✓, then after some few minutes, breathing returns to normal.	(2)
	10.4	Walking	(2)
	10.5	If a man's activity uses 20 kJ per minute, since each activity is conducted per hour, we multiply 20 kJ by 60 ✓minutes, the total is 1200 kJ✓ of which that amount is spent on walking.	(2)
	10.6	As the man is less active at night✓, 300kJ is used for heartbeat ✓/ breathing/ cellular respiration /and minimal turning on sides (slight movements) during sleep.	(2)
			(12)

Activity 11

11			
	11.1	Mortality rate ✓ per 100 000	(1)
	11.2	- Passive smokers can inhale enough smoke to cause lung damage. ✓ - In public places people must smoke outside a building to prevent smoke in the air conditioning system. ✓ - Smoking in a car with a child younger than 12 is against the law as it causes serious lung damage to the child's lungs. ✓ (Any 2)	(2)
	11.3	358 ✓ (220 + 138)	(1)
	11.4	60 : 56 : 12 OR 15 : 14 : 3 ✓✓	(2)
	11.5	Same gender individuals ✓, same age group ✓	(2)
	11.6	Smoking increases the risk of cancer ✓	(1)
	11.7	- Smoke gets trapped in the alveoli ✓ - causing inflammation ✓ - This inflammation activates enzymes ✓ that destroys the lung tissue ✓.	(3)
	11.8		(6)
			(18)

Criterion	Marks
Title	1
Correct type of graph	1
x-axis: correct label and scale	1
y-axis: correct label and scale	1
Bars drawn correctly	1 for 1 – 5 drawn correctly 2 for 6 – 7 drawn correctly

Topic: Excretion

Activity 1

No.	Description	Biological Term
1.1	The process by which the body eliminates metabolic waste products	**Excretion✓**
1.2	The ejection of solid waste from the body	**Egestion ✓**
1.3	The release of useful substances of useful substances(enzyme, saliva)from cells or glands	**Secretion ✓**
1.4	A pair of bean-shaped organs in the abdominal cavity on either side of the mid-line below the diagram	**Kidneys✓**
1.5	A pair of ducts which carry urine from the kidneys to the bladder	**Urethra ✓**
1.6	The functional and structural unit of the kidney	**Nephron✓**
1.7	A tube which runs through the penis carries urine and the semen to the outside	**Urethra ✓**
1.8	The main artery leaving the heart, supplying the body with blood	**Aorta✓**
1.9	A part that brings oxygenated, unfiltered blood to the kidneys	**Renal vein✓**
1.10	An outer membrane covering the kidney	**Renal capsule✓**
1.11	A control of water levels in the body	**Osmoregulation ✓**
1.12	A blood vessels bringing blood from the renal artery into the Bowman's capsule of the nephron and forming the glomerulus	**Afferent arteriole✓**
1.13	A blood vessel taking blood from the renal artery that leaves the Bowman's capsule	**Efferent arteriole✓**
1.14	A cup shaped structure surrounding the glomerulus	**Bowman's capsule✓**
1.15	Specialised cells that lines Bowman's capsule and responsible for ultrafiltration	**Podocytes ✓**
1.16	A hormone responsible for osmoregulation	**ADH/anti-diuretic hormone✓**
		(16 X 1) **(16)**

Activity 2

2			
	2.1	(a) inferior vena cava✓	(1)
		(b) Aorta✓	(1)
		(c) Renal artery✓	(1)
		(d) Renal vein✓	(1)
	2.2	(a) Inferior vena cava✓	(1)
		(b) Urethra ✓	(1)
		(c) Renal vein✓	(1)
	2.3	(a) E✓- bladder✓	(2)
		(b) C✓- Renal artery✓	(2)
		(c) D✓- Ureter✓	(2)
	2.4	The urine will not be transported to the bladder✓ Leading to the pains in the kidney✓ And that can results to death✓	(3)
			(16)

Activity 3

3			
	3.1	kidney✓	(1)
	3.2	- Excretion✓ - Osmoregulation ✓ - pH regulation✓ - Mineral salt regulation ✓ **(Mark first THREE only)** (Any 3)	(3)
	3.3	Renal cortex ✓	(1)
	3.4	(a) Renal pyramid✓	(1)
		(b) Renal pelvis✓	(1)
	3.5	(a) Covers the kidney✓	(1)
		(b) Transport urine from the kidney to the bladder✓	(1)
			(9)

Activity 4

4			
	4.1	(a) Afferent arteriole✓	(1)
		(b) Efferent arteriole✓	(1)
		(c) Glomerulus ✓	(1)
	4.2	Ultrafiltration✓	(1)
	4.3	- Part labelled B is narrower than part labelled A✓ - Narrower diameter of part labelled B therefore, resist the flow of blood by slowing down the rate of blood flow✓ - This creates higher blood pressure✓ in part labelled C - High blood pressure thus generated leads to leakage of blood plasma✓ - with a smaller substances such as glucose, amino acids, water, urea and other nitrogenous waste products through the micro pores✓ on the capillary network at C - Blood cells, plasma proteins and other large solutes are left behind blood✓	(6)
	4.4	Podocytes ✓	(1)
	4.5	- Presents of slit pores✓ - between the podocytes act as selective filters ✓ - allowing only small particles to pass through into the capsular space✓ (Any 2)	(2)
	4.6	- Walls are made up of a single/thin layer✓ to facilitate diffusion ✓of substances - Many tiny pores✓ acts as micro filters, restricting large substances such as proteins/blood corpuscles - Has lot of capillaries✓ to ensure large surface area ultrafiltration	(4)
			(17)

Activity 5

5			
	5.1	Too much water loss✓ High intake of salt✓ / sodium	(2)
	5.2	- The high concentration of sodium✓ creates - a steeper concentration gradient✓ - Which leads to the passive absorption of water✓ - From the collecting tubule into the surrounding fluid✓ - Surrounding the cells at the medulla ✓ (Any 3 X 1)	(3)
	5.3	- The lower level of sodium in the blood stimulates✓ - the adrenal gland ✓to secrete and release - More aldosterone into the blood✓ - Which causes reabsorption of more sodium by the capillaries✓ - At the distal and collecting tubules✓ / less sodium ions are excreted - From the kidneys✓ - Sodium ions are reabsorbed until its level in the blood returns to normal ✓ (Any 4 X 1)	(4)
	5.4	- The diarrhoea and vomiting leads to excessive loss of water and salts✓ - Drops the level of water in the blood✓/causes dehydration - That stimulates the hypothalamus✓/ pituitary gland to release more ADH into the blood (Any 2 X 1)	(2)
			(11)

Activity 6

6			
	6.1	- The volume of water in the blood decreases✓ - Osmoreceptors in the hypothalamus are stimulated✓ and the message is sent to the pituitary gland✓ - The pituitary gland secretes more ADH into the blood✓ - ADH increases the permeability of the walls of the distal convoluted tubule and the collecting tubule✓ - This causes more water to leave the medulla is re-absorbed✓at the faster rate by blood capillaries which surround the tubule✓ - The amount of water in the blood thus increases✓ and concentrated urine is formed and less water is excreted from the body✓ (Any 4 X 1)	**(4)**

Activity 7

7			
	7.1	(b) A-Glomerulus✓	(1)
		(b) B- Bowman's capsule✓	(1)
	7.2	Ultra-filtration✓	(1)
	7.3	(a) Proteins✓	(1)
		(b) Glucose✓	(1)
		(c) Urea✓	(1)
	7.4	- The tubule is convoluted✓, to allow sufficient time for re-absorption of useful nutrients✓/ increases surface area for maximum absorption - The capillary network is in close contact with the tubule✓ to facilitate faster re-absorption of nutrients✓ - The cells of the inner wall of the tubule are richly supplied with many mitochondria✓ to generate energy for active absorption✓ (active transport) of nutrients back to the surrounding capillaries - The cells of the tubule have microvilli✓ to increase the surface area for maximum absorption✓ (Any 2 X 2)	(4)
			(10)

Topic: Population Ecology

Activity 1

No.	Description	Biological Term
1.1	The group of organism of the same species, occupying the same habitat, at the same time.	**Population✓**
1.2	A group of organisms that share similar characteristics and are capable of interbreeding and producing fertile offspring.	**Species✓**
1.3	A group of different species or population that occupy the same habitat.	**Community ✓**
1.4	A percentage increase of a population as a results of a number of births in a given season or year.	**Natality ✓**
1.5	A permanent movement of organism out of specific area.	**Emigration ✓**
1.6	The death of all member of a particular species.	**Extinction ✓**
1.7	A movement of individuals into a habitat.	**Immigration ✓**
1.8	The relationship between two organisms where one completely outcompetes the other.	**Competitive exclusion✓**
1.9	The type of competition between two members of different species.	**Interspecific competition✓**
1.10	The position an organism occupies in an ecosystem.	**Niche ✓**
1.11	The general term which describes the plant species which is first to inhabit an environment.	**Pioneer✓**
1.12	The maximum number of individuals that can be accommodated by the resources of a particular habitat.	**Carrying capacity✓**
1.13	A removal of animals from a flock when population size exceeds the carrying capacity.	**Culling ✓**
1.14	The kind of completion when individuals of the same species living in the same habitat compete for the same food resource.	**Intraspecific competition✓**
1.15	The rate at which individuals die in a population.	**Mortality ✓**
1.16	An illegal hunting and killing of animals.	**Poaching ✓**
1.17	A symbiotic relationship where one organism benefit and the other is harmed.	**Parasitism✓**
1.18	A symbiotic relationship where both organisms benefit from the relationship.	**Mutualism ✓**
1.19	A symbiotic relationship where one organism benefit and other one does not benefit and does not get harmed.	**Commensalism ✓**
1.20	An animal that hunts, kills and eat other organism.	**Predator ✓**
		(20 X1) **(20)**

Activity 2

2			
	2.1	Logistic✓ / S-shaped	(1)
	2.2	A - lag phase✓/ establishment phase	(1)
		B - exponential graph✓ / geometric phase	(1)
		C - Decelerating growth phase✓	(1)
		D - equilibrium phase✓/ stationary phase	(1)
	2.3	(a) D✓	(1)
		(b) B✓	(1)
		(c) B✓	(1)
		(d) C✓	(1)
			(9)

Activity 3

3			
	3.1	A✓	(1)
	3.2	- Growth slowed down and became constant✓ - Since the population reached carrying capacity✓ - Due to environmental resistance✓/ available resource	(3)
	3.3	Starts slowly and then increases rapidly✓	(1)
	3.4	- Human population has not reached the carrying capacity✓ yet - Due to attempts to increase availability of resources such as food✓ - using advancement in agricultural technology✓ - And the production of GMO's using biotechnology✓	(4)
	3.5	Regulation of population growth by proper family planning✓ Allocation of subsides to people that have small families✓	(2)
			(11)

Activity 4

4			
	4.1	A group of organism of the same species, occupying the same habitat at the same time, and capable of random interbreeding✓✓	(2)
	4.2	4%✓	(1)
	4.3	5-9 years old✓	(1)
	4.4	Females ✓	(1)
	4.5	Nigeria ✓	(1)
	4.6	- High birth-rate✓/high number of younger people in population - High death rate✓/ less older people in population/short life expectancy	(2)
	4.7	- Disease✓ - Lack of food✓ - Lac of water✓ - Lack of space✓ (Any 1 X 1)	(1)
	4.8	- Disease✓ – human have developed medical technology✓ so there are fewer deaths - Lack of food – mass produce crops✓ / monoculture / GM foods to increase crop production✓ - Lack of water – building dams✓ to store water for when needed✓ - Lack of space – building high rise apartment building and skyscrapers✓/ creating cities and towns so that people can live in a smaller area of space✓ (Any 1 X 2)	(2)
			(11)

Activity 5

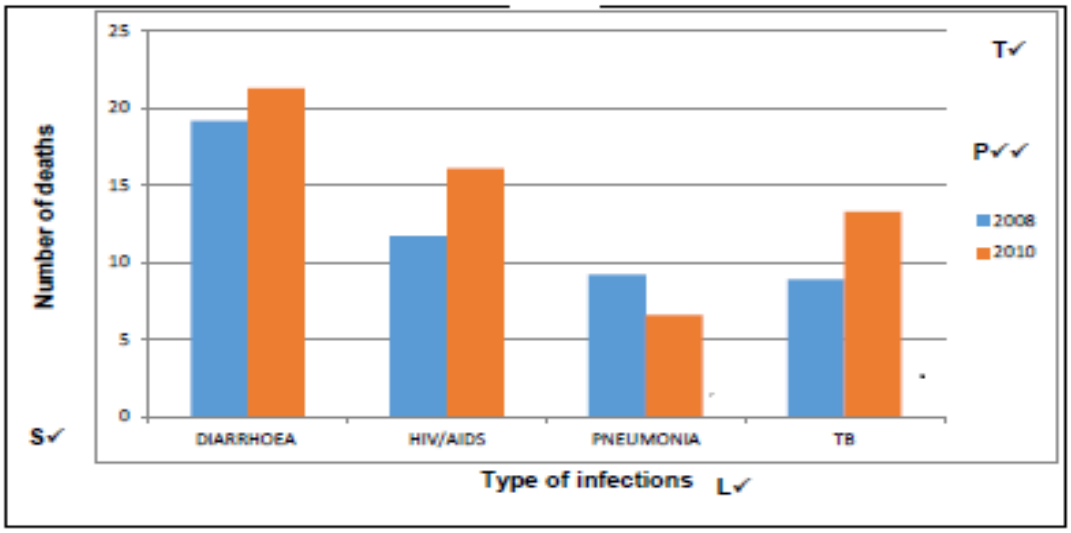
	5.1	Census ✓	(1)
	5.2	B✓	(1)
	5.3	- The base of the age pyramid is wide but it narrows towards the top✓ - This indicates high proportion of individuals in the younger age group✓ - When they grow up and reproduce the population will increase in size✓ - The narrowing of the pyramid towards the top also indicates high death rate with increasing age✓	(4)
	5.4	- The population size at each of the age groups remains almost equal✓ - This indicates that the birth and death rates are almost the same✓. - Therefore , the population will remain more or less the same✓	(3)
	5.5	Stable population✓	(1)
			(10)

Activity 6

6			
	6.1	(a) community consists of populations of populations of different species that live and interact in the same place at the same time✓✓	(2)
		(b) ecological role of species within the structure and function of a community✓✓	(2)
	6.2	*Tribolium confusum*✓ 100 survived in bottle 6 when the temperature was 24 °C and the relative humidity was 30%✓	(2)
	6.3	Density independent factors✓	(1)
	6.4	Since there are two different species involved it can be regarded as interspecific competition✓	(1)
			(8)

Activity 7

7			
	7.1	The number of children with pneumonia✓ has decreased✓	(2)
	7.2	When HIV infection is high, the incidence/ number of children with TB is high✓ OR When HIV infection decreases✓, the number of TB cases also drops✓/ decreases	(2)
	7.3	Survey ✓	(1)
	7.4	**The four causes of death among the children under one year old in 2008 and 2010 in Khayelitsha**	



Mark allocation of the bar graph

Criteria	Marks
Bar graph drawn (T)	1
Title of the graph (Including both variables)	1
Correct scale for X-axis (equal width and spacing of the bars) and Y-axis (S)	1
Correct label of X-axis and correct label of Y-axis including correct unit (L)	1
Drawing of bars (P)	0: No bars plotted correctly 1: 1 to 7 bars plotted correctly 2: All 8 bars plotted correctly

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

(6)

(11)

Activity 8

8			
	8.1	T✓	

Developed countries	Developing countries
1. Low rates of population growth ✓	1. High rates of population growth ✓
2. Highly industrialised✓	2. Less industrialised ✓
3. Low birth rates/ natality ✓	3. High birth rates/ natality ✓
4. Low infant mortality rates/ death✓	4. High infant mortality rates/ death✓
5. Longer life expectancy✓	5. Lower life expectancy✓

(1 + Any 2 X 2) **(5)**

Activity 9

9			
	9.1	$P = \frac{F \times S}{M}$ $= \frac{20 \times 25}{8}$ ✓ ✓ = 63 ✓ fish	(3)
	9.2	Mark-recapture method ✓	(1)
			(4)