

EXAM FEVER

Life Sciences

Grade 10

Workbook Answers

1

Life at the Molecular, Cellular and Tissue Level

Molecules to Organs

A. Chemistry of Life

Exercise 1

Question 1

- | | |
|--------------------------------|--------------------------------------|
| 1. iodine | 11. phosphorous |
| 2. cholesterol/LDL-cholesterol | 12. vitamin A |
| 3. cellulose | 13. iron |
| 4. blubber | 14. potassium |
| 5. enzyme | 15. vitamin C |
| 6. denaturing | 16. goitre |
| 7. pH | 17. disaccharide/
maltose/sucrose |
| 8. vitamin A | 18. amino acid |
| 9. scurvy / anaemia | 19. Saccharides/
monosaccharides |
| 10. rickets
[20] | 20. vitamin B |

Question 2

1. carbohydrate
2. protein
3. carbohydrate
4. fat
5. fat
6. fat
7. protein
8. fat
9. protein
10. fat

[10]

Question 3

- a) B, C [2]
- b) A, E [2]
- c) B, C, D [3]
- d) A, E [2]

Question 4

1. a) B/D
b) A
c) C
d) S
e) C
f) B
g) A
h) A
i) B
j) C [10]
2. Food D has 10mg Vitamin C / 100g
30mg / 10 mg = 3
So: $3 \times 100g = 300g$ of Food D will provide 30mg of
Vitamin C. [2]

Question 5

The amount of potato is constant, 100g, therefore the difference in energy results from the method of cooking. Boiled potato is cooked in water, which contributes no kilojoules; but fried chips are cooked in oil. Oil is a very high source of energy and the oil gets incorporated into the potato when making fried chips. [5]

Exercise 2

Question 1

1. enzyme
2. substrate
3. denaturation
4. Protease
5. optimum temperature

Question 2

1. A + B
2. C
3. A
4. C
5. B

Question 3

1. Humans – the optimum temperature for enzyme activity is 38°C, which is body temperature. [2]
2. 33-40°C (accept +/- 10C on either side) [1]
3. 33% (accept 31-35%) [1]
4. At high temperatures / above 41°C, the enzymes denature and no longer function. [2]
5. The lower the temperature, the slower the enzyme activity, until at 0°C, enzyme activity ceases. This is because enzymes become inactive / deactivated at low temperatures. [2]

Question 4

1. catalysts
2. disaccharide
3. monosaccharide
4. it has not changed shape / it has not been affected
5. temperature + pH

Exercise 3

Question 1

As per image of: A compound microscope, page 9 Note Book.

Question 2

1. a) body tube
b) coarse adjustment knob
c) mirror
d) clips
e) rotating nose piece [5]
2. To magnify a specimen / to enable us to see things that cannot be seen with the naked eye. [2]
3. Low power (x10) [1]
4. mirror condenser diaphragm objective body tube eye piece [5]
5. concentrates light onto the specimen [2]
6. coarse [1]

7. only use 1-5 drops of water; thinly slice the specimen; have no air bubbles under the cover slip; place specimen in the middle of the slide; dry-up excess water; use a clean slide; use the correct stain for the specimen (any 2) [2]
8. diaphragm [1]
9. to prevent contamination of the specimen and to hold the specimen in place [2]
10. Total magnification = magnification of the eye piece lens x magnification of the objective lens [1]
11. lens B [1]
12. magnification = $10 \times 40 = 400x$

Exercise 4

Question 1

1. Starting at the top left label and moving anti clockwise around the image:
 1. air space
 2. cell wall
 3. (Z) cell membrane
 4. cytoplasm
 5. nucleoplasm
 6. nucleolus
 7. nuclear membrane
 8. mitochondrion
 9. (Y) vacuole
 10. (X) chloroplast [10]
2. Plant cell – a chloroplast; cell walls; large vacuole and inter-cellular air spaces are present (any 2) [3]
3. chlorophyll [1]
4. provides turgidity to the cell; regulates cell water content; some contain pigment which provides colour to fruit and flowers (any 2) [2]
5. phospholipids + proteins [1]
6. from the image: $7\text{mm} = 1\mu\text{m}$
but in reality: $7\text{mm} = 7\,000\mu\text{m}$
(remember: $1\text{mm} = 1\,000\mu\text{m}$)
therefore the magnification is: $7\,000x$ [3]

Question 2

1. C
2. D
3. A
4. B
5. C
6. D
7. C

8. C
9. C
10. D
11. C
12. A
13. D
14. C
15. D

[30]

Question 3

1. mitochondrion
2. lysosome
3. chloroplast
4. vacuole
5. ribosome
6. Golgi Body / dictyosome
7. nucleus
8. centrosome
9. chromoplast
10. Centriole

[10]

Question 5

1. 1. chloroplast
2. mitochondrion [2]
2. False. Chloroplasts are not found in the epidermal layer (except for the stomata). They are absent in the epidermal layer in order to allow radiant energy to penetrate to the deeper tissues where photosynthesis occurs. Chloroplasts are not found in root cells because photosynthesis does not occur there. [3]
3. organelle 2 [1]
4. organelle 2 / the mitochondrion – cellular respiration, which releases energy, occurs in the mitochondria. Muscle cells require a lot of energy in order to function effectively. [3]
5. starch grains [1]

Exercise 5

Question 1

1. Starting at the top image, working down the page:
 1. spindle fibres
 2. cell plate
 3. cleavage furrow
 4. cytoplasm
 5. chromosomes / nuclear material [5]
 2. E B A C D [5]
 3. Plant cell – a cell plate is forming, which only happens in plant cells. [3]
 4. A form of cell division which produces two genetically identical daughter cells from a single mother cell. [2]
 5. DNA / chromosomes [1]
- 6.1 Starting from the top left, then moving anti-clockwise around the image:
 1. daughter chromosome
 2. centriole
 3. centromere
 4. spindle fibre [4]
- 6.2 No – this is an animal cell, because centrioles are present. Cell plates do not form in animal cells. [3]
- 6.3 2 [1]
- 6.4

Question 2

1. centromere
2. Centriole
3. Chromosome
4. nuclear division (karyokinesis)
5. Spindle fibres [5]

Question 3

1. D
2. D
3. C
4. A
5. B [10]

2

Life Processes in Plants and Animals

Exercise 1

Question 1

1. root cap, growing point, region of elongation, root hair region, mature region [5]
2. a) root hair region
b) mature region
c) growing point
d) region of elongation
e) root cap [5]

Question 2

1. as per diagram of: a root hair, page 36, Note Book [6]
2. elongated – to increase surface area for absorption; is one cell thick for rapid osmosis of water; cell sap of vacuole is hypertonic which encourages movement of water into the cell via osmosis (any 2) [2]

Question 3

1. a) xylem
b) epidermis
c) cortex / parenchyma
d) pericycle
e) endodermis [5]
2. a) 2
b) 3
c) 5
d) Z
e) 3 [5]
3. diffusion (major pathway) + osmosis (minor pathway) [2]

Question 4

As per diagram: T/S of a young dicot stem, page 33, Note Book [7]

Question 5

- | | | |
|------------------|-----------------------|------|
| a) girth | b) cambium | |
| c) annual rings | d) suberin | |
| e) capillarity | f) Casperian strip | |
| g) root pressure | h) hydathodes | |
| l) wilting | j) transpiration pull | |
| k) potometer | l) guttation | [12] |

Exercise 2

Question 1

Experiment: water droplets appear; turn blue cobalt chloride paper pink. [2]

Control: no water droplets appear; blue cobalt chloride paper does not change colour. [2]

Conclusion: leaves are mainly responsible for the loss of water vapour from plants. [2]

1. To prevent interference with the results of the experiment / if the insides were wet, wouldn't know if the water droplets came from the leaves or were already there. [2]
2. To prevent evaporation of water from the beaker. [2]
3. To prevent water vapour entering / leaving the bell jar + to prevent water vapour leaving the cut surfaces of the twig. [2]
4. It is an indicator – when it changes colour, it indicates the presence of water vapour. [2]
5. Some water vapour left the cut ends of the twig via diffusion. [2]
6. Twigs must be the same size; and from the same species – both these precautions enable comparisons to be made between the experiment + the control; twigs should be cut under water – to prevent air bubbles entering the xylem and thus interfering with transpiration pull (any 2, explained) [4]

Question 2

Table of Results: will vary, “high temperature” will probably be the shortest time, followed by “wind”, then “high humidity”. Table must include “normal” conditions and averages must be calculated. [8]

Deduction: will also vary, depending on the “normal” reading and the results. A likely answer is:

High temperatures cause the most rapid rate of transpiration, followed by windy conditions. Both these environmental factors cause transpiration to be faster than normal. High humidity causes the lowest rate of transpiration / causes transpiration to lower than normal. [5]

1. To prevent air bubbles entering the xylem, breaking the continual column of water and thus interfering with transpiration pull. [2]
2. To push the air bubble back to the starting point on the potometer. [2]
3. Cut the twig under water; ensure the apparatus is air tight (use vaseline around all joints); ensure there are no additional air bubbles in the potometer; place apparatus on a level surface (any 2) [2]
4. high temperatures + high wind speeds [2]
5. To prevent gravity interfering with the movement of the air bubble. [2]
6. That the movement of the air bubble is caused by the transpiration of the leaves. [2]

Question 3

Diagrams:

Root – diagram based on observation, but labeled as per illustration of: T/S of a dicot root, page 32 Note Book.

-All tissues except some endodermis cells + phloem will be stained red. [9]

Stem – diagram based on observation, but labeled as per illustration of: T/S of a young dicot stem, page 33 Note Book.

-Only xylem tissue in vascular bundles should be stained red [9]

1. xylem [1]
2. Xylem tissue is responsible for transporting water in plants. [2]
3. root hairs / epidermis → parenchyma cells of cortex → passage cells of endodermis → pericycle [4]

Exercise 3

Question 1

Starting at the top left of the skeleton and moving around the labels anti-clockwise:

- | | |
|---------------------|---------------|
| 1. clavicle | 2. sternum |
| 3. rib | 4. cartilage |
| 5. vertebral column | 6. pelvis |
| 7. femur | 8. patella |
| 9. pibia | 10. fibula |
| 11. tarsals | 12. phalanges |
| 13. metatarsals | 14. phalanges |
| 15. metacarpals | 16. carpals |
| 17. ulna | 18. radius |
| 19. humerus | 20. scapula |
| 21. skull | [21] |

Question 2

- 2.1 The Pectoral Girdle: collar bone; shoulder blade; muscle; humerus; ball and socket; radius and ulna; radius; carpals; phalanges. [10]
- 2.2 The Pelvic Girdle: femur; patella; tibia; shin. [4]

Question 3

1. A disorder whereby the bones become porous, fragile and may crumble. [2]
2. Inactivity (because bones need to work in order to remain strong); aging; post-menopausal women are particularly at risk; a diet low in calcium. (any 2) [2]
3. collapse of vertebrae; need for hip replacement; bones that fracture very easily; hunched over back (any 2) [2]

Question 4

1. inflammation of the joint [1]
2. wearing down of cartilage between bones, or an auto-immune response whereby the body's immune system attacks the joints [2]
3. all joints, particularly: neck, lower spine, hands, knees, feet [5]

Question 5

1. immovable (fixed); slightly moveable; freely moveable (synovial) [3]
2. synovial [1]
3. sutures / immovable [1]

Question 6

1. Longitudinal section of a synovial joint. [2]
2. Starting at the top left of the image and moving around the labels anti-clockwise:
- | | |
|----------------------------------|----------------------|
| 1. capsular ligament | 2. ligament |
| 3. articular / hyaline cartilage | 4. bone |
| 5. synovial fluid | 6. synovial membrane |
| 7. bone | [7] |
3. Acts as shock absorber and reduces friction. [2]
4. elbow, knee, fingers, hip, shoulder, neck, wrist, ankle (any 3) [3]
5. ligaments connect bone to bone; tendons attach muscle to bone [2]

Question 7

- | | |
|-------------------|--------------------------|
| 1. axial skeleton | 2. femur |
| 3. endosteum | 4. chondrocytes |
| 5. chondrin | 6. ligament |
| 7. tendon | 8. antagonistic |
| 9. sarcolemma | 10. skull / cranium [10] |

Question 8

1. Starting at the top left of the image and moving around the labels anti-clockwise:
- | | |
|---------------------|------------------------|
| 1. spongy tissue | 2. Compact bone tissue |
| 3. Endosteum | 4. periosteum |
| 5. Head | 6. Shaft / diaphysis |
| 7. head / epiphysis | [7] |
2. humerus + femur [2]
3. in the bone marrow, which is located in the marrow cavity [1]
4. calcium [1]

Exercise 4

Question 1

Starting at the top left of the image and moving around the labels anti-clockwise:

- | | |
|-----------------------|---------------------------|
| 1. aorta | 2. superior vena cava |
| 3. right atrium | 4. coronary artery |
| 5. inferior vena cava | 6. ventricle wall |
| 7. coronary vein | 8. left atrium |
| 9. pulmonary veins | 10. pulmonary artery [10] |

Question 2

Starting at the top left of the image and moving around the labels anti-clockwise:

- | | |
|-----------------------|---------------------------|
| 1. superior vena cava | 2. pulmonary artery |
| 3. right atrium | 4. tricuspid valve |
| 5. inferior vena cava | 6. right ventricle |
| 7. tendonous cords | 8. thinner muscular wall |
| 9. septum | 10. thicker muscular wall |
| 11. left ventricle | 12. bicuspid valve |
| 13. semi-lunar valve | 14. pulmonary veins |
| 15. left atrium | 16. aorta [16] |

Question 3

pump; cardiac; septum; deoxygenated; carbon dioxide; oxygenated
four; atria; ventricles; ventricles; left; lungs
arteries; superior vena cava; inferior vena cava; coronary vein; pulmonary; oxygenated; pulmonary; aorta; tricuspid; bicuspid; atria; semi-lunar; relax veins; capillaries; connective tissue; endothelium; squamous; connective; muscle; lumen; pressure; squamous; blood
arterioles; diffuse; carbon dioxide; valves; backward [41]

Question 4

0,8; sino-atrial; right
contract; ventricles; tricuspid; bicuspid; 0,1
contract; bicuspid and tricuspid; pulmonary artery; aorta; semi-lunar; 0,3
relax; superior vena cava; right; pulmonary; 0,4

Question 5

1. When the heart abruptly stops beating; breathing stops seconds later. [2]
2. The coronary artery that carries oxygenated blood to the cardiac muscle becomes blocked (usually by the accumulation of plaque from cholesterol), so the heart muscle becomes starved of oxygen and nutrients. [2]
3. chest pain /pressure (rarely intense in one spot); sweating; nausea; vomiting; weakness; shortness of breath – symptoms usually last for +/- 15 minutes (any 3) [3]
4. stop smoking; lose weight if overweight; exercise regularly; eat healthily + reduce cholesterol intake; reduce emotional stress; try and reduce blood pressure (any 3) [3]
- 5.1. C – they have an elevated heart beat over the entire 25 minute period. [3]
- 5.2. B – they have a slow heart rate to begin with, but at 15 minutes it increases rapidly. [3]
- 5.3. A has a normal / constant heart rate and is probably not doing any exercise, but C has a higher / elevated rate and is probably exercising. [4]

Question 6

tissue; lymph; valves; lymphocytes; subclavian [5]

Question 7

1. Starting at the top left of the image and moving around the labels anti-clockwise:
 1. right lymphatic duct
 2. right subclavian vein
 3. spleen
 4. thoracic duct
 5. left subclavian vein
 6. opening of thoracic duct [6]
2. Return tissue fluid back to the blood; lacteals absorb fats and transport them to the left subclavian vein, where they enter the blood system; lymph nodes contain lymphocytes which have an immune function and destroy pathogens. [3]
3. They prevent the backward flow of lymph / prevent gravity from allowing lymph to drain down to the lower legs and feet. [2]
4. Contraction of skeletal muscles helps move lymph along the lymph vessels. [2]

3

Environmental Studies

Biosphere, Biomes and Ecosystems

Question 1

1. biosphere
2. community
3. biome
4. abiotic components
5. rocky shore
6. endotherm
7. edaphic
8. biotic components
9. nitrogen-fixing bacteria
10. gaseous exchange / breathing / respiration [10]

Question 2

1. That part of the earth, including the lower atmosphere and soil and rocks, which can support life. [2]
2. The soil and rocks where life is found. [2]
3. All the aquatic environments which can support life. [2]
4. The gaseous part of the environment which supports life. [2]
5. The study of the relationship between living organisms and the environments in which they live. [2]
6. An ecosystem is a community of organisms which interact with each other and the abiotic components of the environment within a particular space. [2]
7. A group of different species of organisms that live within a particular ecosystem. [2]

Question 3

1. Nitrogen – required to manufacture proteins in plants and animals. [2]
2. oxygen + carbon dioxide [2]
3. precipitation; streams /rivers; lakes; ice/glaciers; transpiration (any 4) [4]

Question 4

1. occur within a defined geographical region; have a distinct climate + vegetation; consist of several different ecosystems; contain regional communities of organisms; they are named after the dominant vegetation in the region (any 4) [4]
2. Desert – varies depending on rainfall
Succulent Karoo – succulents + small bushy shrubs
Nama-Karoo – sparse grasses + dwarf shrubs
Fynbos – fynbos (proteas, ericas, restios geophytes)
Grassland – grasses
Savanna – grasses, trees + herbaceous plants
Forests – numerous trees of various heights [14]
3. a) it is unique + not found anywhere else in the world; it has very high biodiversity; 68% of the plant species are endemic; a number of animals are only found in the Fynbos; it generates a lot of income from tourism; it creates many job opportunities in the tourism sector (any 3) [3]
b) proteas; ericas; restios; geophytes [4]
c) geometric tortoise; Cape sugarbird; mountain zebra; bontebok (any 2) [2]
4. a) wetland
b) ocean
c) coral reef
d) mangrove [4]

Ecosystems

Question 1

1. D
2. I
3. A
4. F
5. H
6. E
7. C [14]

Question 2

1. aspect; slope; altitude (any 2) [2]
2. a) B – it is the seaward slope, so receives rainfall from the sea. [3]
b) B – slope is gentler, so has more soil + receive more rainfall. [3]
c) A – slope is steeper + soil is drier. [3]
d) B – slope is east-facing and the sun rises in the east. [3]
3. a) shade-loving [1]
b) Most of South Africa is at a latitude which is south of the Tropic of Capricorn, so the sun is always to the north of us. Therefore, south-facing slopes do not receive direct sunlight. [2]
4. 1) Aspect – in SA, north-facing slopes are warmer than south-facing slopes, because of the latitude of the country. [3]
2) Altitude – the higher the elevation, the cooler the temperature. [3]
3) Vegetation cover – the denser the vegetation, the cooler will be lower strata of the ecosystems. [3]

Question 3

1. soil type + soil water content [2]
2. organic matter/humus content; presence of burrowing animals; presence of plant roots (any 2) [2]
3. organisms respire, which release carbon dioxide; decomposition of dead organisms also releases carbon dioxide into the soil air (any 1) [2]
4. a) mangrove [1]
b) have shallow + widely growing root systems; proproots help support the tree; pencil roots enable gaseous exchange during submergence (any 1)[2]

Question 4

1. Y [1]
2. Particles are less than 0,002mm in diameter; retain the most water; have very small air spaces; become water-logged easily; particles are plate-like and compact together; clay soils do not support plant growth (any 3) [3]
3. a) X [1]
b) It is a sandy soil, so will drain very quickly, which is required for a soak pit. [2]
4. silt + sand [2]
5. a) No [1]
b) Air spaces are very small, which means that soil becomes water-logged easily, so plants will drown/rot. Small air spaces also mean it is hard for plant roots to penetrate the clay. The clay particles compact together, which also makes it very difficult for root penetration. [3]

Question 5

1. To determine the amount of air present in a sample of soil. [2]
2. a) (100ml water + 100ml soil) – soil-water mixture ml = 200ml – 175ml = 25ml there was 25ml of air in the soil sample [3]
b) $25\text{ml air} / 100\text{ml soil} \times 100\% = 25\% \text{ air in the soil}$ [2]
3. to enable living organisms to respire; to enable soil to drain when wet; to prevent the accumulation of carbon dioxide in the soil (from cellular respiration), which can stunt plant growth [3]

Trophic Relationships

Question 1

1. For each biome, arrows should start at the producer and end at the quaternary consumer. [3]
2. There will be many different answers, for example:
Grassland – any nature reserve on the Highveld
Pond – school pond, farm dam
Ocean – Indian or Atlantic ocean [3]
3. a) A producer is an autotroph that manufactures its own food by photosynthesis, while a primary consumer is a herbivore that eats plants. [2]
b) A secondary consumer is a carnivore (or omnivore) that eats primary consumers and a tertiary consumer eats secondary consumers, so is higher up the food chain. [2]
c) Phytoplankton is plankton that is autotrophic and manufactures its own food via photosynthesis; zooplankton comprises of tiny animals that are heterotrophic. [2]
4. Freshwater biomes have fresh water, are located on land, and many are seasonal.
Ocean biomes have salty water, are located away from land / at sea, and are not affected by the seasons. (any 2) [2]
5. a) grass, phytoplankton (algae is an autotrophic protist, not a plant)
b) grasshopper, mosquito larva, zooplankton
c) rat, snake, eagle, dragonfly larva, fish, otter, fish, seal, shark
d) rat, snake, eagle, dragonfly larva, fish, otter, fish, seal, shark
e) grasshopper, mosquito larva, zooplankton (any 2 examples for each answer) [10]

Question 2

1. a) A: zebra, F: locust [2]
b) D: human [1]
c) B: spider, E: lion, D: human (any 2) [2]
d) C: green plant [1]
2. green plant zebra lion human or: green plant locust spider human/lion [4]
3. They represent the flow of energy and nutrients as they are consumed by consecutive organisms along the food chain. [2]
4. The producer / plant would have no consumers, so its population size would grow very large; but because the food supply of the secondary and tertiary consumers has been removed, the secondary consumers would starve to death.
For a short while, the tertiary consumers would still have the secondary consumers to eat, but once they had all been consumed, the tertiary consumers would also starve to death. [3]

Question 3

- 1.
2. The food chain is based on only 1 tree - the pyramid of numbers reflects this, so it has a small base. At every level in the food chain, energy is lost, so pyramids of energy always have a broad base and a narrow apex, reflecting the successive loss of energy along the chain. [5]
3. Energy is lost via all the metabolic processes, eg: cellular respiration, tissue repair, growth, reproduction and metabolism, as well as being lost in metabolic wastes that are excreted and defecated. [4]
4. The total mass of the organisms at each trophic level. [2]

Question 4

1. bean plant → aphids → ladybirds → bird [5]
2. 4 [1]
3. In a food chain, if one organism/trophic level is removed, all the trophic levels above it collapse. However, because a food web has numerous different species of organisms represented at each trophic level, if one species is removed, there are still other species at the same level which can act as a food source, so there is less chance of the entire food web collapsing. [4]

4. a) A [1]
b) B [1]
5. a) To breakdown dead organic matter and release the nutrients contained in the tissues back into the ecosystem so that they may be recycled and reused. [2]
b) Decomposition would happen at a much slower rate and there would be an accumulation of dead organic matter, and nutrients would be recycled much more slowly. Ecosystems would probably collapse. [2]

Nutrient Cycles

Question 1

1. a) Provides radiant energy which is the source of energy for all ecosystems. Radiant energy is converted into chemical potential energy during photosynthesis. [2]
b) Responsible for photosynthesis. Without producers, radiant energy could not be harnessed for life. [2]
becoming too large and also contribute to the recycling of nutrients in the ecosystem. [2]
d) Ensure that there is not an accumulation of excretory products + dead organic matter in the ecosystems. Responsible for the ultimate release of nutrients back into the ecosystem. [2]
2. In a drought, the producers / plants often die first. The nutrients contained within them will be recycled during their decomposition, but those nutrients will go straight back into the soil, rather than passing through various consumers first. There will be less nutrients available for animals in the higher trophic levels during a drought. [4]

Question 2

1. E – nitrates in soil
F – animal protein
G – ammonia [3]
2. A – nitrogen fixation / lightening
B – consumption / digestion
C – absorption
D – denitrification
H – decomposition [5]
3. Decomposition enables all nutrients that are contained within dead organisms to be released back into the environment for reuse. Proteins are converted to ammonia, which ultimately is decomposed into nitrates which are reabsorbed by plants. Carbohydrates are decomposed into carbon dioxide + water. The CO₂ is recycled during photosynthesis and water is used in all metabolic activities. [4]
4. a) beans [1]
b) Beans are legumes which have nitrogen-fixing bacteria in the nodules of their roots. The bacteria are able to convert atmospheric nitrogen gas (N₂) into nitrates that are then utilized by the beans to manufacture proteins and grow. Wheat is not a legume and so is dependent on the amount of nitrates in the soil for growth. [5]
c) Wheat is not a legume and so is dependent on the amount of nitrates in the soil for the production of proteins and growth. So in a nitrate-poor soil, the growth of wheat will be limited. [4]

4 Diversity, Change and Continuity

Biodiversity

Question 1

- Refers to all the variations amongst different species as well as all the variations within a species, in a particular space. [2]
- Ecosystem diversity – refers to the number of different types of ecosystems within a particular area, for example within a biome, or a country. [3]
Species diversity – is the number of different species living within a particular ecosystem, biome or country.
Generic diversity – refers to the variations of genes within a single species. [3]
- Sustainable utilization means using only a limited amount of a resource and ensuring that enough of the resource is left unused so that it can replenish itself. It also means ensuring that the resource will still be available for the use of future generations of people. [2]
- leave enough of a resource so that it can regrow; plant/replace resources that are used; find alternatives to the resource if they are limited/scarce; recycle and reuse where possible; develop new biotechnologies that use less of the resource; don't use resources wastefully; educate people about resources and wasteful consumption (any 4, there will be others) [4]

Question 2

- Hotspots are areas which have great biodiversity and high levels of species endemism, but are vulnerable or threatened by destructive human activities. [2]
- Fynbos + Succulent-Karoo [2]
- a) Fynbos [1]
b) 6,7% [1]
c) It has one of the greatest levels of biodiversity in the world and 70% of its plant species are endemic/only found in that region. [2]

- Insufficient water to support many plants. [1]
- a) species that occurs naturally in a particular area [2]
b) species that only occurs in a particular area [2]
(All endemic species are indigenous, but not all indigenous species are endemic.)

Classificaton

Question 1

- F h) T
 - F l) T
 - T j) F
 - T k) F
 - F l) F
 - T m) T
 - F [13]
- snakes + crocodiles
 - cats + dogs
 - insects + crabs
 - lions + tigers
 - foxes + dogs
 - cats + lions [6]
- Panthera leo (lion)
 - Panthera tigris (tiger)
 - Felis concolor (mountain lion)
 - Felis domesticus (house cat) [4]
- 7 [1]
- Chondrichthyes
 - Osteichthyes
 - Amphibia
 - Reptilia
 - Mammalia [5]
 - They all contain a spinal cord / notochord [1]
 - body covering is hair; warm blooded; females have mammary glands to feed offspring; differentiated teeth are present [4]

Question 2

- Robert Whittaker [1]
- Domains are a larger classification unit than kingdoms.
The Eukaryota domain consists of the: Protists, Fungi, Plant + Animal kingdoms.
The Eubacteria domain is similar to the Monera kingdom, but excludes extinct forms.
The Archaeobacteria domain consists of the ancient / extinct Monera species. [2]
- [15]

	Monera	Protists	Fungi	Plants	Animals
Example (there are many)	Bacteria	Amoeba Malaria protist	Yeast, mushroom	Baobab, daisy	Rhino, butterfly
Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
Unicellular	Unicellular	Unicellular	Unicellular/ Multicellular	Multicellular	Multicellular
Nutrition	Auto- trophic / hetero- trophic	Auto- trophic / hetero- trophic	Hetero- trophic / sapro- phytic	Auto- trophic	Hetero- trophic
Type of re- production	Asexual	Asexual / sexual	Asexual / sexual	Sexual	Sexual

Question 3

- Prokaryotes [1]
 - They do not contain a nucleus or have organelled bound by membranes. [2]
- Archaeobacteria + Eubacteria [2]
- unicellular, eukaryotic, may be autotrophic or heterotrophic [3]
 - uni-or multicellular, eukaryotic, heterotrophic + many are saprophytic, cell walls contain fungi-chitin [3]
 - multicellular, eukaryotic, autotrophic, cell walls contain cellulose [3]
- They have a placenta which provides the foetus with nutrients from the mother's blood supply during pregnancy. [2]
 - They have opposable thumbs for grasping; eyes are directed forwards which provides binocular vision; their fingernails are flat. [3]
 - Dogs walk on 4 limbs, not 2; they are covered in hair + have a tail; their 4 limbs are the same length. [3]

History of Life on Earth

Question 1

- The division of the history of the earth into smaller units based on the major geology / rock formations that happened in that time. [2]
- It makes it easier to understand the vast time intervals that have occurred in the past. [2]
- million years ago [1]
- 3 800 mya [2]
- a) 500 mya [2]
b) Plants photosynthesize so they add oxygen to the atmosphere, which is necessary for cellular respiration of all organisms. The atmospheric oxygen also created the ozone layer, which protects terrestrial organisms from radiation damage, so plants had to produce sufficient oxygen + ozone before other organisms could move to land. [2]
- Devonian [1]
- Tertiary + Quaternary [2]
- 250mya – 65mya = 185 million years [3]

Question 2

- F 4. F
- F 5. T
- T 6. F [6]

Question 3

- Fish dies and sinks to the bottom of a shallow water body, but is not eaten or decomposed, nor is the body broken up by currents in the water or washed away from where it lies. [3]
- Shortly afterwards, a flood deposits sediment onto the body. During this time, decomposition of the soft tissue has started, but the skeleton has not been scavenged and is still intact. [3]
- Over a long period of time, more layers of sediment are deposited on top of the skeleton. [2]
- The mass of the layers of sediment cause compression, which causes the sediment to become rock.
The minerals in the skeleton and teeth of the fish are replaced with hard minerals like silica and calcium carbonate. This mineralisation of the skeleton causes it to become rock, and it is now called a fossil. The process of fossilisation takes 1000s of years. [4]

Question 4

- a) stromatolites /cyanobacteria [1]
b) early land plants: club mosses, lycopods, ancestral gymnosperms and algae [5]
c) mammal-like reptiles / therapsids, early mammals, dinosaurs, turtles, crocodile-like amphibians, freshwater fish, Thrinaxodon and Lystrosaurus (any 6) [6]
- Australopithecus africanus – Sterkfontein caves [3]
Australopithecus sediba – near Sterkfontein caves [3]
Homo sapiens – Florisbad in the Free State. [3]

Question 5- Research Assignment

Each learner / pair of learners will research different fossils.

Useful websites include:

www.cradleofhumankind.co.za

· (Cradle of Humankind, UNESCO World Heritage Site)

www.maropeng.co.za

· (visitor information for Cradle of Humankind)

www.originslearningacademy.co.za

· (Wits Origins Centre)

www.ditsong.org.za/naturalhistory.htm

· (South African Natural History Museum)

· southafricanpaleocaves.wordpress.com (South African Palaeocave Survey)

www.fossilpark.org.za

· (West Coast Fossil Park)

www.thegreatkaroo.com/.../fossils_and_reptiles_of_the_great_karoo

· (Karoo National Park fossils)

· www.cdic.co.za > [Area Information](#) (Drakensberg fossils)

· whc.unesco.org > Culture > World Heritage Centre > The List (UNESCO World Heritage Sites)

· commons.wikipedia.org/wiki/Category:

Fossils of South Africa

Question 6

- Pangaea [1]
- continental drift [1]
- In the late Triassic (+/- 235mya), Pangaea split into two super-continents: Gondwana in the south + Laurasia in the north. Over the next 200my, the two continents continued splitting up and moving apart. This was caused by movements in the earth's crust which caused the tectonic plates on which the continents are positioned to move. As the continents split, the oceans began to widen. The tectonic plates are still moving and in millions of years time, the present continents will not be in the same position they are now. [6]
- Because there are no fossils of Glossopteris in the northern hemisphere, it must have evolved after Pangaea had split into Gondwana and Laurasia. The fossils are distributed on eastern South America, the whole of southern Africa and southern Australia. Those three continents used to join and were part of Gondwana, so Glossopteris must have evolved before they split apart. If scientists know when those three continents split, then they can deduce that Glossopteris must have evolved before that time. [4]

Question 7

- a) Formed by petrification or mineralization. Bones are covered by layers of mud or sand. Over thousands of years, minerals in the sediment replace the bone tissue, causing a fossil to form. [4]
b) Sediment surrounds a dead organism. The sediment hardens to become rock. The organism either totally disintegrates or is dissolved by weak acidic soil water. Because the disintegration happens after the sand becomes rock, the three-dimensional shape of the organism remains in the rock. [4]
c) These are created by an organism having moved through an area when conditions were right for soft material (either mud or lava) to harden quickly, leaving an impression of either footprints, animal trails or nests. [4]
- tar, resin, peat, glaciers, ice [4]

Question 8

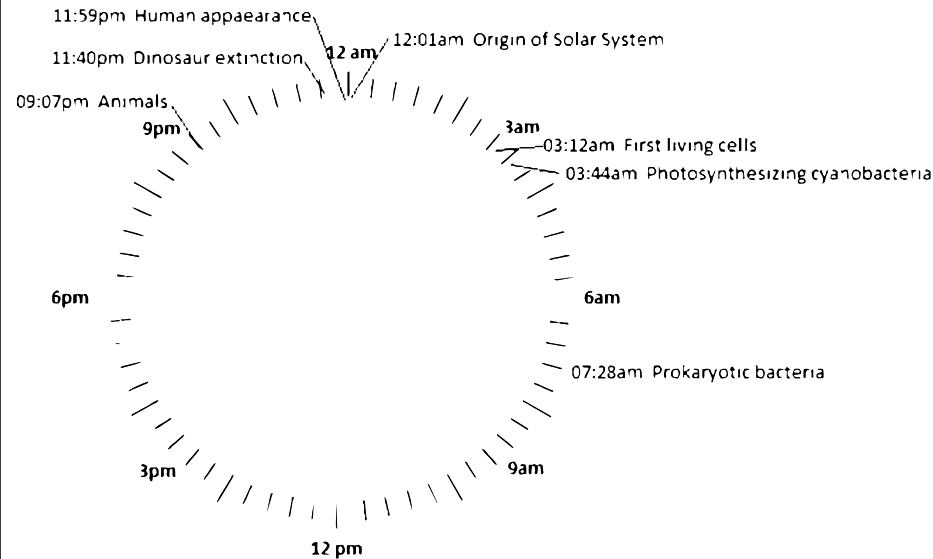
- Mould / impression – a mould of the feathers has been left behind in the rock in which the fossil is found. It appears that mineralization of the skeleton has also occurred, as the skeleton appears darker and three dimensional. [3]
- [9]
- feathers are present; has wings; skeleton appears narrow and light-weight; has belly ribs; fingers are reduced in length [5]
 - teeth are present; has three claws; has a long tail [3]
- Yes – it shows evidence of having some body features which are like the older reptiles, while also having features similar to those of the more recently evolved birds. [3]
- Mesozoic era (late Jurassic period) [1]
 - Solnhofen valley, southern Germany [1]
 - Herman von Meyer (in 1861) [1]
 - carnivore – probably ate small arthropods + reptiles [1]
 - the Natural History Museum in London, England [1]

Question 9



- The data provided in this question is confusing and it is not possible to answer the questions, using a 12 hour clock. Suggestion: add: 12pm at the bottom of the clock (in the 6 o' clock position), thus changing it to a 24 hour clock. (please see how the answers have been done).
Then change question: 7.2 to: question 2 (delete the 7) and change 12 hours to 24 hours [7]

This has been corrected in the later edition.



Clock representing the Earth's history

- 4,6 billion / 4 600 million [1]
 - humans have been alive for 1 minute out of 24 hours
24 hours = 24 x 60min = 1 440 minutes
So humans have existed for $\frac{1}{1440} \times 100\% = 0,07\%$ of the earth's history [2]

Question 10

- A period that started 570mya when suddenly hundreds of different species emerged. [2]
- fish → amphibians → retiles → dinosaurs → birds → mammals [5]
- 5 [1]
 - Permian [1]
 - 250mya [1]
- When tourists visit an area specifically to see the fossils which occur there. [2]
- To see fossils.
To learn about the environmental conditions that existed when the fossils were living.
To generate employment for local fossil tour guides.
To act as research sites for paleontologists, archaeologists and anthropologists. (any 2) [4]
- Maropeng,
The Cradle of Humankind in Gauteng/NW Province;
The West Coast Fossil Park at Langebaan, Western Cape; T
he Karoo National Park, Western Cape [3]