

MARKING SCHEME

BIOLOGY 2

Year 2022

1. (a)

- The lowest classification taxon at which a cobra and human are grouped together is the **phylum**, in this case, phylum Chordata **01 Mark**
- The reasons are;
 - Presence of a notochord during the embryonic stage of development
 - Presence of a hollow, dorsal nerve cord
 - Pharyngeal(visceral) clefts present (slits in the pharynx)
 - Post-anal tail
 - Limbs formed from more than one body segment

Only 4 points @ 02 Marks= 08 Marks

(b)

(i) Genus: *Taenia* **01 Mark**

(ii)

A-Hooks

B-Suckers

C-Neck region (young proglottids)

D-Terminal (gravid) proglottids

@ 01 Mark=04 Marks

(iii)Structures A (Hooks) and B (Suckers) are for anchoring the parasite on the intestine wall (mucosa) and resist being swept away by peristalsis **02 Marks**

(iv)

- Causes obstructions to the intestinal lumen
- Bladder worm cysts can cause cysts in the brain and eyes resulting into blindness, epilepsy, paralysis or even death
- Uses digested food from the host, resulting into poor nutrition of the host
- Can form cysts in the muscles causing muscle pains
- Can cause bleeding from the site of attachment leading to anaemia
- Can cause abdominal pain thus interfering with feeding

Any 4 points @ 01 Mark= 04 Marks

2. (a)

(i) Secondary growth is the one which occurs after primary growth as a result of the activity of lateral meristems and results in an increase in girth **01 Mark**

(ii) The meristematic tissues involved in secondary growth are the two **lateral meristems** called **the vascular cambium** and **the cork cambium**

Secondary growth, usually occurs in woody stems, but can also occur in some woody roots, such as those above the ground **01 Mark**

(iii) Formation of secondary tissues from the meristems;

- The vascular cambium begins to develop between the primary xylem (inside) and the primary phloem (outside). The vascular cambium appears at the beginning of the zone of differentiation **01 Mark**

- The vascular cambium are of two types , **fusiform initials** which are long and become vascular, and **ray initials** which are short and bar-like, these become rays **01 Mark**

- Initially the vascular cambium is present in the form of a thin strip between the primary xylem and primary Phloem known as **fascicular cambium** (Intrafascicular cambium). In the medullary rays, it is present as **Inter fascicular cambium** between the neighboring vascular bundles. **01 Mark**

- **Development of a complete cylinder of cambium.** The joining of intrafascicular and Interfascicular cambium leads to the formation of complete ring called “cambium ring” **01 Mark**

- **Activity of the cambium ring:** the intrafascicular cambium produces secondary phloem to the outside and secondary xylem to the inside by mitotic divisions. **The amount of secondary xylem produced is much more than the secondary phloem, because the cambium is more active on the inner side than outside.** The cambium cells divide radially to increase the growth in circumference and tangentially to form secondary xylem inwards towards the pith **01 Mark**

- **The secondary xylem occupies the major portion of the stem forming a hard compact mass.** The original ray initials produce primary medullary rays which run all the way from pith to cortex, unlike the secondary medullary rays produced by

later ray initials (which passes through the secondary xylem and the secondary phloem in the radial directions). **01 Mark**

- Primary xylem gets pushed towards the center and becomes nonfunctional but remains intact, pith get reduced. **01Marks**

- Primary and secondary phloem gets crushed due to accumulation of secondary xylem; primary is crushed and is pushed outwards **01Marks**

- With the increase of secondary xylem; some of the peripheral tissues also get stretched, it brings about the rupture of cortex and epidermis. These are replaced by **cork** that develops from cork cambium **01 Mark**

(iv)

➤ **Rays (ray initials)**

- They help to transmit water and mineral salts from the xylem and food substance from the phloem; radially across the stem
- Also gasses exchange can occur by diffusion through intercellular spaces
- Rays may also be used for food storage, an importance function during period of dormancy, as in winter

Three functions@1 Mark= 03 Marks

➤ **Periderm**

It is the outer protective tissue of secondary plant body which replaces the ruptured epidermis of expanding primary plant body **01 Mark**

➤ **The secondary xylem**

Conduction of water and mineral salts **01 Mark**

➤ **The secondary phloem**

Translocation of food substance from synthesizing center of the plant to other parts of the plant **01 Mark**

(b)

- The growth pattern shown by fish is known as **Isometric growth** **01 Mark**
- This occurs when an organ grow at the same mean rate as the rest of the body. **01 Mark**
- In this situation change in size of the organisms in not accompanied by a change in shape of the organisms. **01 Mark**

3. (a)

- Endotherms can maintain their body temperature within a constant range irrespective of the variations in the external temperatures.
- Therefore, the endotherms can live in cold polar climates because their body temperatures are not affected by the temperatures outside, hence their different metabolic reactions can occur at relatively constant rates, hence these animals are active all the time
- However, endotherms are not so numerous in the hot desert climates since the bodies of the endotherms produce heat in the bodies of endotherms, so there will be a problem of reducing heat from the bodies of endotherms.
- In this way, the endotherms will use some of their energy in reducing their body temperatures, (i.e. cooling their bodies), which is a disadvantage
- On the other hand, ectotherms cannot maintain their body temperatures within a constant range, hence their body temperatures fluctuates with that of the surrounding
- In the cold polar climates, the body temperatures of the ectotherms will be so low that virtually no reaction will take place in their bodies. Hence, they cannot survive in these climates
- In the hot desert climates, the body temperatures of the ectotherms will be higher just like that of the surroundings, hence the metabolic reactions will be occurring at high rates, hence these animals are very active in the hot desert climates

Seven (7) points @ 01 Mark=07 Marks

(b)

(i) **The proximal convoluted tubule**

Active transport of substances back into capillaries and water follows by osmosis through permeable walls, up to 80% of the filtrate reabsorbed.

(ii) **The descending limb of the loop of Henle**

Water leaves by osmosis into concentrated tissue of medulla; sodium and potassium ions move into the tubule by diffusion down concentration gradients; from the tissue fluid of the medulla; as concentration of tissue increases through medulla, diffusion gradients

maintained all the way along the descending limb; so contains very concentrated solution at hairpin.

(iii)The ascending limb of the loop of Henle

Chloride ions removed from filtrate into tissue fluid of medulla by active transport; sodium ions follow down electrochemical gradient ; but walls of ascending limb are impermeable to water ; so, water cannot follow by osmosis; results in very high concentration of mineral ions in the tissue fluid of the medulla.

(iv)The distal convoluted tubule

Permeability of the walls of the distal tubule varies with the levels of ADH; sodium ions may be actively pumped out; with chloride ions following down an electrochemical gradient; further concentrating the medulla; water may leave by osmosis concentrating the urine; if the walls of the tubule are permeable in response to ADH; other substances may be actively secreted into the distal tubule concentrating the urine.

(v) The collecting duct

Permeability of the collecting duct to water is also controlled by the level of ADH; if walls are permeable water moves out by osmosis into the concentrated tissue fluid of the renal medulla; urine becomes more concentrated; water can be removed by osmosis along the length of the collecting duct; as the concentration of the tissue fluid of the medulla increases from cortex to pyramids maintaining a concentration gradient; this produces urine very hypertonic to blood.

@ 02 Marks= 10 Marks

(c)

- (i) Strenuous exercise causes more sweating, so more water is lost . This decreases the water potential of the blood. This is detected by osmoreceptors in the hypothalamus, which stimulates the posterior pituitary gland to release more ADH. **01½ Marks**
- (ii) The ADH increases the permeability of the walls of the distal convoluted tubule and collecting duct. This means more water is reabsorbed into the medulla and into the blood by osmosis. **01½ Marks**

4. (a)

(i) mRNA is larger, has a greater variety of types and is shaped as a long single helix **while** tRNA is smaller, has fewer types and is clover-leaf in shape. **02 Marks**

(ii) A codon is the triplet of bases on messenger RNA that codes for an amino acid **while** anticodon is the triplet of bases on a transfer RNA molecule that is complementary to a codon **02 Marks**

(iii) Exons are the coding sequences that code for amino acid sequence of the protein **while** Introns are the non-coding sequences present in the DNA, which are removed by RNA splicing before translation. **02 Marks**

(iv) Any change to one or more nucleotide bases, or a change in the sequence of the bases, in DNA is known as a gene mutation **while** Changes in the structure or number of whole chromosomes are called chromosome mutations. **02 Marks**

(b)

(i) DNA needs to be stable to enable it to be passed from generation to generation unchanged and thereby allow offspring to be very similar to their parents. Any change to the DNA is a mutation and is normally harmful. **02 Marks**

(ii) mRNA is produced to help manufacture a protein, e.g. an enzyme. It would be wasteful to produce the protein continuously when it is only needed periodically. mRNA therefore breaks down once it has been used and is produced again only when the protein is next required. **02 Marks**

(c)

(iii) Male cats cannot be tortoiseshell, because a tortoiseshell cat has two alleles of this gene. As the gene is on the X chromosome, and male cats have one X chromosome and one Y-chromosome, then they can only have one allele of the gene **02 Marks**

(iv)

Parental phenotype	Tortoiseshell female	Orange male
Parental genotypes	$X^{CO} X^{CB}$ 0½ Mark	$X^{CO} Y$ 0½Mark
Gametes	(X^{CO}) or (X^{CB}) 0½ Mark	(X^{CO}) or (Y) 0½ Mark

		Genotypes of eggs	
		X^{CO}	X^{CB}
Genotype of sperm	X^{CO}	$X^{CO} X^{CO}$ Orange female 01 Mark	$X^{CB} X^{CO}$ Tortoiseshell female 01 Mark
	Y	$X^{CO} Y$ Orange male 01 Mark	$X^{CB} Y$ Black male 01 Mark

5. (a)

- In malarial regions, the disadvantages of having the disease will be offset by the advantages of having resistance to malaria and so there will be little if any selection against the gene and its frequency will be relatively high. **02 Marks**
- In non-malarial regions there is no advantage in having resistance to malaria and so individuals with sickle cell anaemia will be at a disadvantage; they will be selected against and the frequency of the gene will be low. **02 Marks**

(b)

- (i) Stabilizing
- (ii) Stabilizing
- (iii) Directional
- (iv) Disruptive
- (v) Disruptive

@01 Marks=05 Marks

(c)

- The **light coloured (non-melanic) form** **01 Marks**
 - This is because pollution control means buildings are no longer black.
 - The melanic form is therefore more conspicuous than the light form and so preferentially eaten by predators.
 - The light form is more likely to survive and reproduce to give more light-coloured offspring
 - There is a selection pressure favouring the light form that has led to it outnumbering the melanic form.

05 Marks

(d)

(i) **Speciation** is the evolution of new species from existing species. **01 Mark**

(ii)

- Geographically isolated populations may experience different environmental conditions.
- In each population, phenotypes that are best suited to the particular environmental conditions are selected.
- The composition of the alleles in each gene pool therefore changes as they pass to subsequent generations.
- The composition of the gene pool of each population becomes increasingly different over time.
- Being geographically isolated, individuals of each population cannot breed with one another and so the two gene pools remain separate and different.

04 Marks

6.

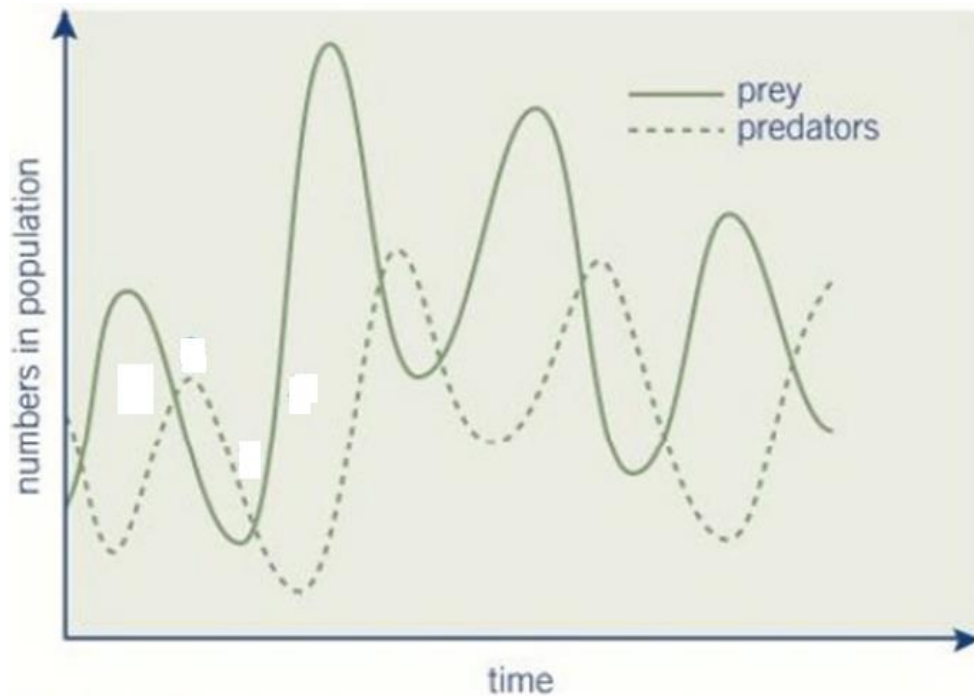
(a) The range and variety of laboratory habitats are much smaller than in natural ones. This means that in nature there is a greater range of hiding places and so the prey has more space and places to escape the predator and survive **03 Marks**

(b)

- Graph showing population fluctuations (peaks and troughs) of A.

- Species B mirrors these changes after a time lag. The population size of B is, for the most part, smaller than A.
- B eats A → population of A falls → fewer A for B to eat → population of B falls → fewer B means fewer A are eaten → population of A rises → more A means more food for B → population of B rises.

Correct explanations=06 Marks



A general predator prey graph

Correct diagram =03 Marks

(c)

- Population over-estimated (appears larger) as there will be proportionally fewer marked individuals in the second sample. **01Mark**
- Population over-estimated/ appears larger as there will be proportionally fewer marked individuals in the second sample because all the 'new' individuals will be unmarked. **01 Mark**
- No difference because the proportion of marked and unmarked individuals killed should be the same **01 Mark**

(c) Given:

- Number of woodlice first captured and marked (n_1) = 120
- Number of woodlice captured in a second sample (n_2)=120
- Total Population of woodlice (N)= 960

Required;

- Number of marked animals in second sample (n_3)=?

Data analysis =02 Marks

From the equation;

$$\text{Total Population (N)} = \frac{\text{Number of woodlice first captured, X Number of woodlice marked and released}}{\text{Number of marked woodlice in second sample}} \times \text{Number of woodlice captured in second sample}$$

01 Mark for correct formula

Then,

$$960 = \frac{120 \times 120}{n_3}$$

$$n_3 = \frac{120 \times 120}{960}$$

$$n_3 = 15$$

Therefore, number of marked animals in second samples is 15

02 Marks final answer