**6093 Biology Yearly TYS 2019**

| No | Paper 1 | Marks | Remarks |
|---|---|---|---|
| 1 | B | 1 | |
| 2 | D | 1 | |
| 3 | C | 1 | |
| 4 | B | 1 | |
| 5 | D | 1 | |
| 6 | D | 1 | |
| 7 | B | 1 | |
| 8 | C | 1 | |
| 9 | B | 1 | |
| 10 | A | 1 | |
| 11 | D | 1 | |
| 12 | B | 1 | |
| 13 | B | 1 | |
| 14 | C | 1 | |
| 15 | D | 1 | |
| 16 | A | 1 | |
| 17 | C | 1 | |
| 18 | C | 1 | |
| 19 | C | 1 | |
| 20 | D | 1 | |
| 21 | C | 1 | |
| 22 | D | 1 | |
| 23 | B | 1 | |
| 24 | D | 1 | |
| 25 | C | 1 | |
| 26 | A | 1 | |
| 27 | D | 1 | |
| 28 | D | 1 | |
| 29 | A | 1 | |
| 30 | A | 1 | |
| 31 | C | 1 | |
| 32 | C | 1 | |
| 33 | A | 1 | |
| 34 | D | 1 | |
| 35 | D | 1 | |
| 36 | D | 1 | |
| 37 | D | 1 | |
| 38 | A | 1 | |
| 39 | B | 1 | |
| 40 | C | 1 | |
| | Total | 40 | |

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| | **Paper 2** | | |
| | **Section A** | | |
| 1ai | Cell surface membrane/ cell membrane;<br>Partially permeable + controls substances entering or leaving the cell by allowing only some substances to pass through; | 1<br>1 | |
| 1aii | Ribosome;<br>Attached to the ER + synthesise proteins that are usually transported out of the cell; | 1<br>1 | |
| 1b | Large number of mitochondria releases large amount of energy by aerobic respiration + many functions carried out by liver;<br><br>Many vital functions<br>e.g. regulation of BGC/<br>production of bile to emulsify fats into smaller fat droplets in small intestines/<br>breakdown of haemoglobin and storage of iron/<br>synthesis of proteins such as prothrombin and fibrinogen/<br>deamination of amino acids into ammonia and then urea/<br>detoxification of alcohol into acetyledehyde by alcohol dehydrogenase | 1<br><br><br>1 | |
| 1c | Cellulose cell wall<br>Chloroplast<br>Large central vacuole | 2 | |
| 1d | Increase surface area to volume ratio +<br>increasing the rate of absorption of digested food substances through the epithelium of villi;<br><br>epithelium is made up of epithelial cells with microvilli + epithelium is one-cell thick to shorten diffusion distance for faster absorption of digested food; | 1<br><br><br>1 | |
| | Total | 10 | |

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| 2a | A: right atrium +<br>B: left atrium +<br>C: right ventricle +<br>D: left ventricle;<br><br>A and B have the same lowest thickness of 3mm + thinner muscular walls compared to the C and D + they only force blood into the ventricles + does not need to withstand high pressure;<br><br>D has a thicker muscular wall of 12 mm compared to C (5 mm) + to withstand higher pressure than that in C + to pump blood round the whole body;<br><br>C has a thinner muscular wall of 5mm compared to D (12 mm) + need to withstand lower pressure than that in D + to pump blood to lungs located close to the heart; | 1<br><br>1<br><br>1<br><br>1 | R: no quotation of data |
| 2b | Oxygenated blood in the left atrium will mix with the deoxygenated blood in the right atrium + amount of oxygenated blood flowing into left ventricle, aorta and the rest of the body is reduced/ lowered;<br><br>Blood transports less oxygen (hypoxemia) + insufficient oxygen supply for aerobic respiration in cells (hypoxia) + body cannot function as per normal/ feels tired easily/ lacks energy to function; | 1<br><br>1 | |
| 2c | Atherosclerosis | 1 | |
| | Total | 7 | |

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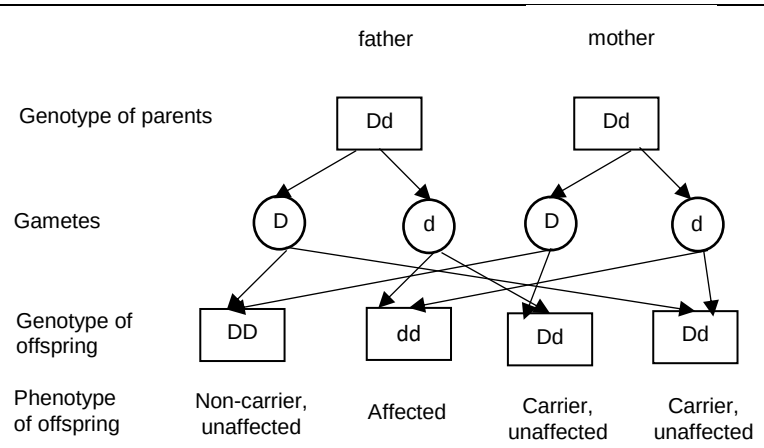
| 3a | Water molecules move from 1 (xylem) to 2 (mesophyll cell) by osmosis down water potential gradient;<br><br>Water molecules moves out of the mesophyll cells by osmosis to form a thin film of moisture over surfaces of the mesophyll cells;<br><br>Water evaporates from the thin film of moisture into water vapour + moves into 3 (intercellular air spaces) + water vapour accumulates in the large air spaces near the stomata;<br><br>creating a higher concentration of water vapour in the leaf than the air outside the leaf + water vapour diffuses out of leaf through 4 (stoma) into 5 (surrounding air);<br><br>Water potential of cell sap in mesophyll cells decreases + mesophyll cells continuously absorbs water by osmosis from 1 + results in a suction force that pulls water up the xylem vessel (transpiration pull); | 1<br><br>1<br><br>1<br><br>1<br><br>1 | |
| 3b | J: Upper epidermal cell<br>Adaptation: no chloroplasts + allowing maximum light to pass through and reach mesophyll layer;<br><br>K: palisade mesophyll cell<br>Adaptation: numerous chloroplasts + absorb light for photosynthesis; | 1<br>1<br><br>1<br>1 | |
| 3c | In daylight, p/s occurs, rate of p/s is higher than rate of r/p + carbon dioxide is rapidly used up in the leaf;<br><br>Concentration of carbon dioxide in the leaf becomes lower than that in atmospheric air creating a diffusion gradient + carbon dioxide diffuses into the air spaces of the leaf through opened stomata;<br><br>Oxygen production increases due to increase rate of p/s + excess oxygen diffuses out of the leaf through opened stomata;<br><br>Water vapour accumulated diffuses out of the leaf through the opened stomata + increasing rate of t/p + increasing transpiration pull + plant cells continuously absorbs water + maintains turgidity of cells; | 1<br><br>1<br><br>1<br><br>1 | |
| | Total | 13 | |

<table>
<tr><td>4a</td><td> 
</td><td>1<br>1<br>1<br>1</td><td></td></tr>
<tr><td>4b</td><td><table>
<tr><td></td><td>d</td><td>d</td></tr>
<tr><td>D</td><td>Dd</td><td>Dd</td></tr>
<tr><td>d</td><td>dd</td><td>dd</td></tr>
</table>
Using Punnet squares to determine the probability, chance of every child not having cystic fibrosis but are carriers is 50% + ratio applies to every child <u>independent of number of offspring/</u><br>actual ratio is far from expected ratio because <u>smaller sample size</u> is used to obtain the expected ratio</td><td>1</td><td></td></tr>
<tr><td>4c</td><td>Mutation is a sudden random change in the structure or in the chromosome number of a gene;<br><br>Error may occur during replication of gene or chromosome + error is not repaired + gene is modified/ chromosome is altered + inherited by offspring through fertilisation;</td><td>1<br><br>1</td><td></td></tr>
<tr><td>4d</td><td>Exposure to UV light/ X-rays/ carcinogens/ mutagens/ alpha, beta and gamma radiation/ chemicals like tar and formaldehyde in cigarette smoke/ lysergic acid diethylamide (LSD) drug;</td><td>1</td><td></td></tr>
<tr><td></td><td>Total</td><td>12</td><td></td></tr>
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|---|---|---|---|
| 5ai | C C G A T A | 1 | |
| 5aii | nucleotide | 1 | |
| 5ab | Social implications:<br>May cause allergies in humans/<br>Easier and cheaper to produce medicine + more affordable + more patients can get access to them and be treated/<br>Higher risk of contamination by disease-causing microorganism present in chickens/<br>Loss of biodiversity due to drop in population of chickens/<br>May be toxic or cancer-causing + modifying a single gene could result in alteration of metabolic processes producing unwanted toxins/<br><br>Ethical implications:<br>Vegetarians or religious groups will object the use of medicine obtained from animals/<br>Morally wrong to exploit animals for medical research/<br>Deliberate creation of new combinations of genes that may be used in chemical or biological warfare/ | Any 2<br><br>Any 2 | |
| | Total | 6 | |
| 6a | Energy is lost through metabolic processes e.g. aerobic respiration in the form of <u>heat/ thermal energy</u>;<br><br>Energy is lost through the excretion of undigested matter/ leftover of the parts of animals that are inedible or unconsumed in the form of <u>chemical energy</u>; | 1<br><br>1 | |
| 6b | $\frac{1600-90}{1600} \times 100\%$<br>$= 94.375\%$<br>$= 94\%$ | 1<br><br>1 | |
| 6c | About 90% of energy lost at every trophic level/ only about 10% of energy transferred to the next trophic level;<br><br>small amount of energy available at the highest trophic level; | 1<br><br>1 | |
| | Total | 6 | |

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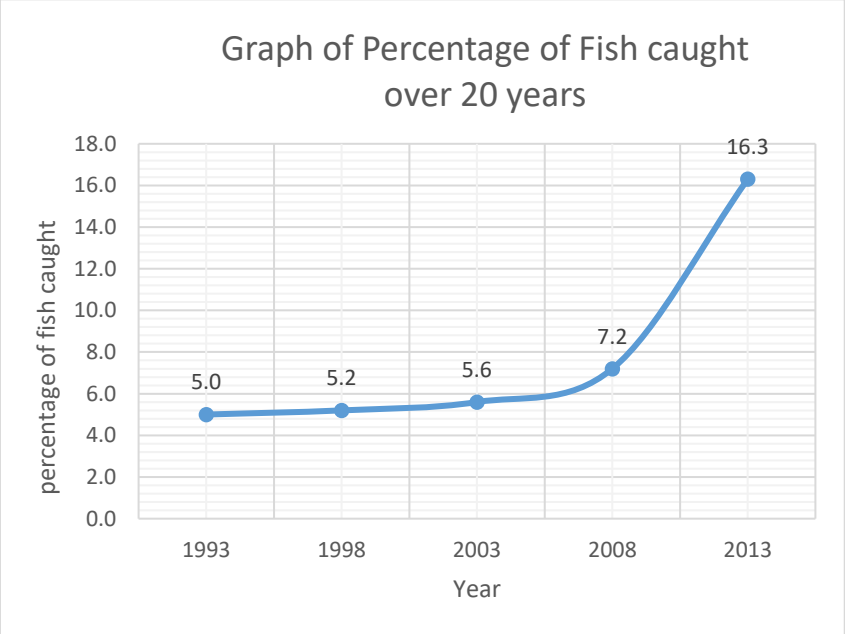
| | **Section B** | | |
| 7ai |  <br>Axes labelled + all ticks labelled at equal intervals;<br>Best fit line + no shading + smooth curve;<br>All points plotted accurately;<br>Maximise the size of grid provided; | 4 | |
| 7aii | 10.2% ± 0.5 | 1 | |
| 7bi | % of fish caught is <u>slight increase</u> for the first 10 years from 1993 to 2003 with percentage ranges from 5.0 % to 5.6 %;<br><br>% of fish caught <u>increases rapidly</u> after 2003 to 2008 from 5.6 % to 7.2 % + increases rapidly after 2008 to 16.3 %; | 1<br><br>1 | R: no quotation of data |
| 7bii | Large % of big fishes indicates that there are <u>higher number</u> of predators/ secondary and tertiary consumers;<br><br>Implying that there is a <u>larger population</u> of primary consumers to support the large population of secondary and tertiary consumers + <u>sufficient amount of producers</u> for the primary consumers to thrive/grow and reproduce;<br><br>Indicating that the populations are healthy + <u>growth and reproduction are not affected</u> by any diseases + <u>balanced</u> ecosystem + fishes can grow well through adulthood and reproduce; | 1<br><br>1<br><br>1 | |
| | Total | 10 | |

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| 8a | Ultrafiltration + caused by high hydrostatic blood pressure + water and small molecules e.g. glucose, amino acids, mineral salts and nitrogenous waste products are forced out of the glomerular capillaries into the Bowman's capsule forming a filtrate;<br><br>blood cells, platelets, proteins and fats are retained in the glomerular capillaries as they are too large to pass through the partially permeable basement membrane;<br><br>Selective reabsorption at PCT + most mineral salts, all glucose and amino acids are selectively reabsorbed by diffusion and active transport into the surrounding blood capillaries + water is reabsorbed by osmosis + water is also reabsorbed at the loop of Henle and collecting duct + water and mineral salts are reabsorbed at DCT;<br><br>Excess water, excess mineral salts and nitrogenous waste products e.g. urea, creatinine, uric acid, pass out of collecting duct into the renal pelvis as urine; | 1<br><br>1<br><br>1<br><br>1 | |
| 8b | Blood is drawn from the vein in the patient's arm and pumped through the tubing in dialysis machine + tubing is bathed in dialysis fluid + walls of tubing are partially permeable;<br><br>Small molecules such as urea and other metabolic waste products diffuse out of the tubing from the blood into the dialysis fluid + blood cells, platelets and large molecules remain in the tubing;<br><br>Dialysis fluid contains the same concentration of essential substances as healthy blood + ensures that essential substances such as glucose, amino acids and mineral salts do not diffuse out of the blood into the dialysis fluid;<br><br>Dialysis fluid does not contain metabolic waste products + sets up a steep concentration gradient that allows waste products such as urea, uric acid, creatinine and excess mineral salts to diffuse out of the tubing into the dialysis fluid + steep water potential gradient to allow excess water molecules to move out of the blood into the fluid by osmosis through the ppm of the tubing;<br><br>Tubing is narrow, long and coiled increasing surface area and volume ratio which helps to speed up the rate of exchange of substances between the patient's blood and the dialysis fluid;<br><br>Direction of the blood flow is opposite to the flow of the dialysis fluid to maintain the concentration gradient for the removal of waste products; | 1<br><br>1<br><br>1<br><br>1<br><br>1<br><br>1 | |
| | Total | 10 | |

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| E9a | BGC above normal level stimulates the islets of Langerhans in the pancreas to secrete insulin;<br><br>Insulin stimulates<br>the conversion of excess glucose into glycogen in the liver, glycogen stored in liver +<br>Insulin stimulates the increase permeability of cell surface membrane to glucose, glucose absorbed more quickly by cells<br>Insulin stimulates the increase cell metabolism;<br><br>Glucose removed from bloodstream + decreasing BGC to normal level;<br><br>BGC below normal level stimulates the islets of Langerhans in the pancreas to secrete glucagon;<br><br>glucagon stimulates<br>conversion of stored glycogen back into glucose +<br>Glucagon stimulates conversion of fats and amino acids into glucose;<br><br>These cause glucose to enter the bloodstream hence, increasing BGC to normal level; | 1<br><br>1<br><br><br><br><br>1<br><br><br><br>1<br><br>1 | Stimulus<br><br>Effect of insulin<br><br><br><br>Effect on BGC<br><br>Stimulus<br><br><br><br>Effect of glucagon<br><br>Effect on BGC |
| E9b | Thermoreceptors in the skin detect the drop in temperature in external environment + send nerve impulses to brain + hypothalamus stimulated + send nerve impulses to effectors;<br><br>Constriction of skin arterioles and dilation of shunt vessels + less blood flows through blood capillaries in skin + reduce heat lost by convection, radiation and conduction;<br><br>Sweat glands are less active + results in decrease production of sweat + less water in sweat evaporates from surface of skin + less latent heat of vaporisation lost from body;<br><br>increased metabolic rate + increase the amount of heat released within the body;<br><br>Body can gain heat by shivering + reflex contraction of muscles + sporadic contraction of skeletal muscles increases the amount of heat released + raise body temperature; | 1<br><br>1<br><br><br>1<br><br><br>1<br><br><br>1 | Stimulus + receptor<br><br>Blood vessels<br><br><br>Sweat glands<br><br><br>Metabolism<br><br><br>Shivering |
| | Total | 10 | |

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| O9a | Enzymes provide an alternative pathway with lower activation energy required to start a chemical reaction to speed up chemical reactions;<br><br>Anabolic reactions + build up complex substances from simpler substances + Catabolic reactions + break down complex substances into simpler substances;<br><br>Specificity of enzymes + only substrate with 3D shape complementary to 3D shape of active site can fit into enzyme to form enzyme-substrate complex;<br><br>Chemical reaction occurs and substrate is converted to products + products leave active site + enzymes remain unchanged so can be reused and are only required in small amounts;<br><br>Enzymes are inactive/ low rate of reaction at low temperatures below optimum + most active/highest rate of reaction at optimum temperatures + denature at temperatures beyond optimum/<br>Rate of enzyme reaction is the highest at optimum pH + enzymes denature at extreme pH/<br>Increase enzyme concentration results in an increased rate of reaction | 1<br><br>1<br><br>1<br><br>1<br><br>1 | Activation energy<br><br>Anabolism<br>Catabolism<br><br>Specificity<br><br>Remain unchanged<br><br>1 factor affecting rate of enzyme reaction |
| O9b | Digestive enzymes are involved in chemical digestion of food + break down large food molecules into small soluble molecules which can be absorbed into the bloodstream;<br><br>Salivary amylase in saliva secreted by salivary glands is most active in neutral pH 7 + digests starch into maltose in the mouth;<br><br>Pepsin in gastric juice secreted by gastric glands is most active in acidic pH 2 + digests proteins into polypeptides in the stomach;<br><br>Pancreatic lipase in pancreatic juice secreted by pancreas is most active in alkaline pH + digests fats into fatty acids and glycerol in small intestines;<br><br>Pancreatic amylase in pancreatic juice secreted by pancreas is most active in alkaline pH + digests starch into maltose in small intestines;<br><br>Maltase secreted by pancreas and intestinal glands is most active in alkaline pH + digest maltose into glucose in the small intestines;<br><br>*Other acceptable examples: maltase, lactase, trypsin, sucrose, pancreatic amylase, peptidases, intestinal lipase* | 1<br><br>4 | Role of digestive enzymes<br><br>4 examples specify<br>- Enzyme<br>- Substrate<br>- Products<br>- Location<br>- Gland<br>- pH |
| | Total | 10 | |