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TYS Answers 2022 (ThatBioTutor Edition)

IMPT NOTE:

- *For differences between 2023 and 2024 syllabus, see this list here.*
- **Shaded black = out of syllabus from 2024 onwards*

Question	Ans	**Question**	Ans
1	**D**	21	**B**
2	**B**	22	**B**
3	**D**	23	**A**
4	**B**	24	**C**
5	**C**	25	**D**
6	**B**	26	**B**
7	**C**	27	**D**
8	**D**	28	**D**
9	**A**	29	**B**
10	**D**	30	**A**
11	**B**	~~31 *~~	~~B~~
12	**B**	32	**B**
13	**C**	33	**D**
14	**D**	34	**C**
15	**D**	35	**C**
16	**D**	36	**A**
17	**A**	37	**D**
~~18 *~~	~~C~~	38	**B**
19	**A**	39	**A**
20	**D**	~~40 *~~	~~A~~

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Q1.

(a)

- Red blood cells are biconcave, increasing its surface area to volume ratio for faster diffusion of oxygen in and out of the cell.
- It lacks a nucleus, making space for more haemoglobin to be packed in, increasing its capacity for oxygen transport.
- It is flexible, so it can squeeze through tiny capillaries in order to reach the tissues that it needs to deliver oxygen to.

(b)
(i)

- 91% is lower than the healthy range of 95-100%, so the person lacks blood oxygen.
- Walking up stairs requires energy for muscular contractions, which is generated via aerobic respiration, which uses oxygen.
- The person may feel more exhausted than a healthy person, and may feel out of breath.

(ii)

- Pulmonary vein.
- It contains blood that has just passed through the lungs, at which it received oxygen from alveolar airspaces and had its carbon dioxide removed.

(c)

- Carbon dioxide: Transported to lungs to be excreted during exhalation.
- White blood cells/Lymphcytes/Phagocytes/Antibodies: circulate in blood providing defence against disease

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Q2.

(a)
(i)

- Palisade mesophyll cell.

(ii)

- The large central vacuole.

(iii)

- Nucleus/Mitochondria/Rough endoplasmic reticulum/Smooth endoplasmic reticulum/Ribosome/Golgi body.
    - ~~*Reject: Centrioles (only found in animal cells!)*~~

(b)

- After awhile, most of the chloroplasts will be found near the top of each of the leaf cells.
- They would have migrated towards the top, to get near to the light source to receive more light,
- So more light energy is absorbed by chlorophyll within them, and converted to chemical energy for a higher rate of photosynthesis.

(c)

**Compare = Similarities OR Differences*

Any 3:

- Water enters the cell via osmosis, while carbon dioxide enters via diffusion.
- Water moves down a water potential gradient, while carbon dioxide moves down its concentration gradient.

- Both substances move from a region where there is a higher proportion of them to a region where there is a lower proportion of them.

- Both substances pass through the partially permeable plasma membrane when entering the cytoplasm.
- Both substances move without the use of energy, as diffusion and osmosis are passive processes.
    - **Reject: Both move down a concentration gradient (water moves down a water potential gradient, not concentration gradient)*

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Q3.

(a)

- Filaments will be long and pendulous, allowing the anthers to protrude out of the flower
- Anthers will be large in order to produce a lot of pollen

(b)

(i)

- Carbon, Hydrogen, Oxygen.

(ii)

Choose 2:

- There is lesser digestible carbohydrate in brown flour than white flour, 72.0g/100g compared to 76.3g/100g for wheat flour, and 76.5g/100g compared to 80.1g/100g for rice flour.
- There is more indigestible carbohydrate in brown flour than white flour, 4.6/100g compared to 2.4g/100g for rice flour, and 10.7g/100g compared to 2.7g/100g for wheat flour.
- There is more protein in brown flour than white flour, 7.2/100g compared to 5.9g/100g for rice flour, and 13.2g/100g compared to 10.3g/100g for wheat flour.
- There is more fat in brown flour than white flour, 2.8/100g compared to 1.4g/100g for rice flour, and 2.5g/100g compared to 1.0g/100g for wheat flour.

(iii)

- Conduct biuret's test by mixing 1.0g of flour with 2cm^3 of biuret's reagent in a test tube and shake well.
- Let it stand for 5 minutes, and if the mixture turns violet, protein is present.

(c)

- When villi decrease in size and number decrease, total surface area to volume ratio of villi decreases,
- Decreasing the rate of absorption of digested food substances via diffusion and active transport throughout the small intestine,
- And less glucose and amino acids will be absorbed into blood capillaries, less fats enter lacteals as fat globules, hence less nutrients can be used for assimilation by the body.

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Q4.

(a)
(i)

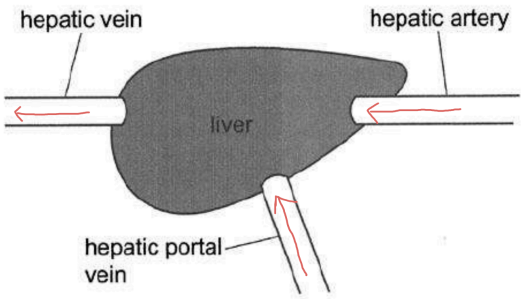

Fig. 4.1

(ii)

- Hepatic vein.

(b)
(i)

- The total population in areas A and B may be different, hence using a common denominator of 100 000 men allows us to make a fair comparison.

(ii)

- Overall, area A had a higher number of cases per 100 000 men than area B the entire period from 1960 to 2000.
- In area A, number of cases climbed steadily from 38/100 000 in 1960 to 64/100 000 in 1975, then decreased steadily to 35/100 000 in 2000.
- In area B, number of cases increased gradually from 6/100 000 in 1960 to 13/100 000 in 1995, then increased sharply to 25/100 000 in 2000.

(iii)

Choose 1:

- Due to higher awareness of the importance of healthy a lifestyle/Due to better education of alcohol's health impacts in area A, less people drank alcohol excessively, leading to lower rates of serious liver disease.
- Due to better healthcare treatments in area A, more people received treatment that prevented serious liver disease.
- Alcohol minimum age might have been raised/taxes were placed on alcohol, less people could buy and consume it, decreasing prevalence of serious liver disease.

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(iv)

Choose 2:

- Increased reaction time/slowed reflexes and coordination under the influence of alcohol
- Tendency to act irrationally
- Increased risk of peptic/stomach/gastric ulcers
- Addiction, leading to neglect of social responsibilities

(c)

(i)

- An organ upon which a hormone acts and elicits a response from/stimulates to carry out a response.

(ii)

- When blood glucose is lower than set-point, cells of islets of Langerhans in the pancreas secrete more glucagon,
- Which causes liver cells to convert glycogen to glucose and release it into the bloodstream, increasing blood glucose back to set-point.

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Q5.

(a)

Choose 1:

- Temperature/pH of environment/concentration of organic compounds in sewage.

(b)

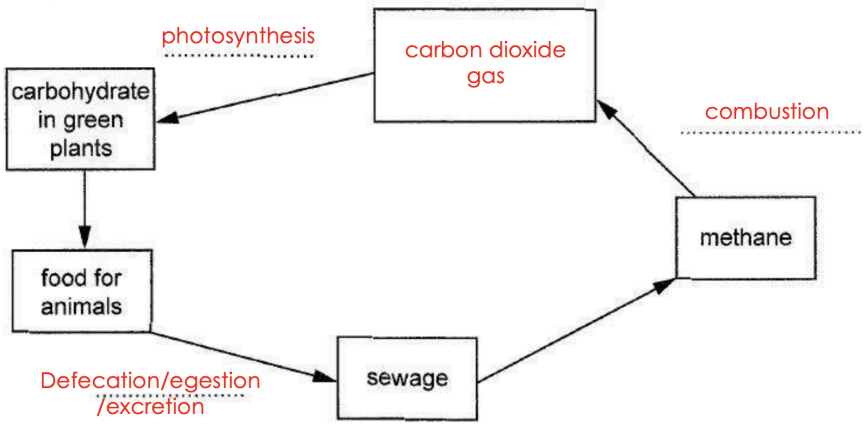

Fig. 5.1

(c)

- Different microorganisms contain different a DNA nucleotide sequences, hence have different genes.
- These different genes are transcribed into different mRNA strands, which are translated by ribosomes into a unique sequence of amino acids, forming unique polypeptides.
- These fold into proteins with different 3D shapes, and hence are different enzymes with unique active sites.

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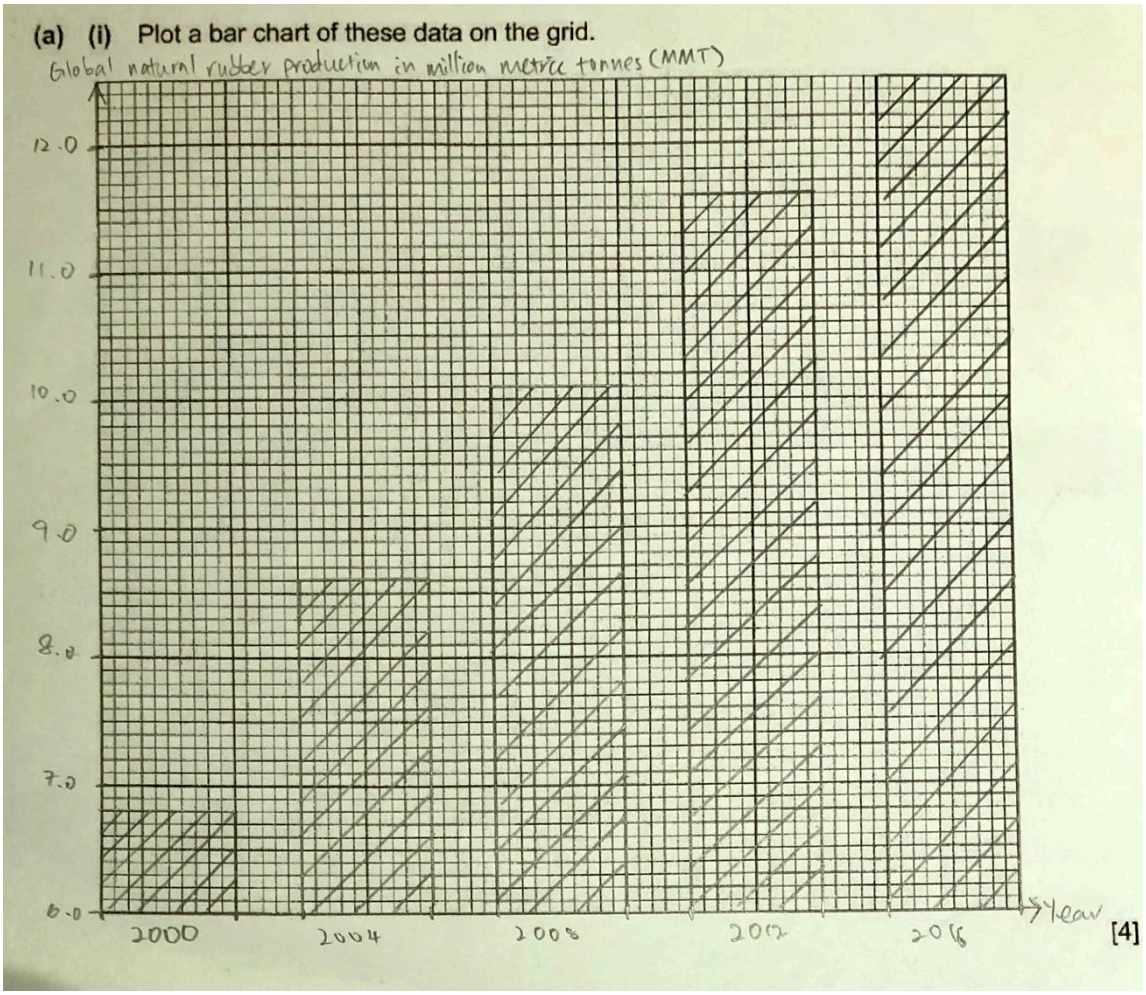
Q6.
(a)(i)



(a)(ii)

- (12.5 – 6.8)/6.8 = **83.8%** (3s.f.)

(b)

Choose 4:

- Replacing natural tropical rainforests would lead to a loss of habitat for native wildlife, leading to loss of biodiversity.
- As plantations are less dense than forests, this replaces it with a less effective carbon sink, more CO_2 stays in the atmosphere, increasing global warming.
- It could also lead to soil erosion as plantations are less dense than natural forests, so there is less tree roots to hold soil together as well as less canopy cover to protect topsoil from the force of rain.
- Eroded soil may be deposited in rivers, blocking water flow, causing water level to rise and causing floods.
- After topsoil is eroded, the barren land can no longer support plant life, leading to possible desertification of the area.

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- Fertilisers will be used, which may be washed by rain into nearby water bodies, causing eutrophication.
- After polluting water bodies, toxic chemicals in fertilisers may be involved in bioaccumulation and biomagnification, poisoning top consumers of food chains, further decreasing biodiversity.

(c)

- Phloem.

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Q7.

(a)

- Ultrafiltration occurs here, where most of the blood plasma and its dissolved substances are forced out of the glomerulus into the bowman's capsule,
- Due to high (hydrostatic) blood pressure created due to the efferent arteriole having a smaller lumen than the afferent arteriole.

Choose 2 more:

- The wall of the glomerular capillaries and Bowman's capsule are one-cell-thick, minimising the distance substances need to travel, so they can enter the Bowman's capsule faster.
- The partially permeable basement membrane wrapping around glomerular capillaries allows small substances such as water and urea to enter the bowman's capsule,
- But prevents red blood cells, white blood cells, platelets and proteins from passing through.

(b)

Choose 2:

- Blood proteins may be found in urine
- Red blood cells may be found in urine
- White blood cells may be found in urine
- Platelets may be found in urine

(c)

(i)

- It is the maintenance of a constant internal environment,
- involving negative feedback, where changes to internal environment stimulate corrective mechanisms that bring it back to set-point.

(ii)

- Osmoregulation is carried out by the kidneys, to maintain constant water potential in the blood, and is controlled by Antidiuretic hormone.

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Either Q8.

(a)
(i)

Choose 2:

- There are fewer alveoli in the long-term smoker than the non-smoker.
- The alveolar walls of the long-term smoker have many holes in them and are broken down, while that of the non-smoker are fully intact.
- Alveoli are larger in the long-term smoker than the non-smoker.
    - *Reject: Elasticity lost (non-visible)*

(ii)

- Fewer alveoli/larger alveoli/broken down alveolar walls decreases surface area to volume ratio of alveoli for gaseous exchange,
- Oxygen diffuses into the long-term smoker's blood slower than a non-smoker's, making them easily out of breath during exercise.
- Carbon dioxide (CO_2) diffuses out of the long-term smoker's blood slower than a non-smokers, and it may build up in the blood.
- As CO_2 is acidic, blood pH to falls, which is harmful to body cells and can be lethal if severe.
    - *Reject: Elasticity lost (non-visible)*

(b)

- This increases the risk of high blood pressure, and atherosclerosis, where fatty deposits accumulate on the inner walls of arteries, narrowing the lumen.
- If this occurs in a coronary artery, and the fatty deposit ruptures, a blood clot could form, blocking the artery.
- Blood with oxygen and nutrients cannot reach the heart muscles for them to release energy via aerobic respiration, hence they die, resulting in a heart attack.
- If this instead occurs in an artery to the brain, it can lead to stroke.

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Or Q8.

(a)

- When looking at near objects, the lens becomes thicker and more convex, ~~*having a shorter focal length,*~~ this refracts light more,
- allowing light rays from the near object to be focussed sharply on the retina, producing a clear image.
- When looking at far objects, the lens becomes thinner and less convex, ~~*having a longer focal length*~~, this refracts light less, producing a clear image.

(b)
(i)

- The cloudy patch could refract light unevenly, resulting in blurriness in the centre of the field of vision, while the peripheries remain clearer.
- A cataract is partially opaque, and reduces the total light that reaches the retina, hence vision may appear dimmer than usual.
- ~~*It would be harder to see colours distinctly, as cones in the retina which allow us to see in colour need high brightness to function well.*~~
- The cataract could cause light to scatter in such a way that the person may have double vision in one or both eyes.

(ii)

- Percentage of people with diabetes who have cataracts = 1980/4613 = 42.9%, percentage of people without diabetes who have cataracts = 7138/45387 = 15.7%
- There is a correlation between diabetes and cataracts, implying that diabetes increases risk of cataracts.
- However, correlation does not mean causation, there could be other underlying reasons increasing risk of cataracts, but there was no other health data compared.
- It was also not a fair comparison as sample size was smaller for diabetics than non-diabetics, which could have misrepresented the true prevalence of cataracts in diabetics.

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