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TYS Answers 2019 (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	B	21	C
2	D	22	D
3	C	23	B
4	B	24	D
5	D	25	D
6	B	~~26 *~~	~~A~~
7	B	27	D
8	C	28	D
9	B	29	A
10	A	30	A
11	D	31	C
12	B	~~32 *~~	~~€~~
13	B	~~33 *~~	~~A~~
14	C	34	D
15	D	35	D
16	A	36	D
17	C	37	D
~~18 *~~	~~€~~	38	A
19	C	39	B
20	D	~~40 *~~	~~€~~

Q1.

(a)

(i)

- A is the plasma membrane.
- It is partially permeable and regulates the movement of substances in and out of the cell.

(ii)

- B is a ribosome that is studded on the Rough Endoplasmic Reticulum.
- It synthesises proteins at the Rough Endoplasmic Reticulum which are meant for secretion out of the cell.

(b)

- The liver is in charge of various metabolic processes such as the breakdown of hormones/excess amino acids into urea/harmful substances such as alcohol/synthesis of bile ~~synthesis of blood proteins~~, which requires a lot of energy.
- Hence liver cells need many mitochondria to generate large amounts of energy via aerobic respiration.

(c)

Choose 2:

- Cell wall
- Chloroplasts
- Large central vacuole

(d)

- Microvilli increase surface area to volume ratio of the small intestine in contact with the contents of the lumen,
- For faster absorption of digested food substances such as glucose and amino acids from the lumen into epithelial cells.

Q2.

(a)

- Chambers A and B have the thinnest walls of 3mm as they are the atria of the heart,
- And only need to pump blood a short distance into the ventricles hence do not need to be that muscular.
- Chamber C has a thickness of 5mm as it is the right ventricle, and D which is the left ventricle is of 12mm.
- C only needs to pump blood to the lungs, whereas D needs to pump it around the whole body to a further distance and at higher pressure, hence requiring thicker muscular walls.

(b)

- This allows oxygenated and deoxygenated blood to mix, so blood pumped out the aorta around the body will be less oxygenated,
- Cells around the body receive less oxygen for aerobic respiration to release energy, the person will feeling easily fatigued/weak/short of breath/fainting/dizzy.

(c)

- A diet high in saturated fats/sedentary lifestyle/smoking.

Q3.

(a)

- As water potential of mesophyll cells is lower than that of the xylem,
- Water moves from xylem vessels at (1) into mesophyll cells at (2) by osmosis to replace the water lost.
- Water then moves out of mesophyll cells, forming a thin film of moisture.
- This film evaporates into water vapour in the intercellular air spaces at (3).
- Water vapour diffuses out the leaf via a stoma at (4), down its concentration gradient, to the surrounding air outside the leaf at (5).

(b)

- J is an upper epidermal cell.
- It is transparent to allow as much light to pass through and reach the mesophyll cells below so they can conduct photosynthesis at the highest rate allowable.

- K is a palisade mesophyll cell.
- It has many chloroplasts so more photosynthesis can occur.
- OR: It is long, cylindrical and vertically arranged so many of them can be packed together so more photosynthesis can occur.

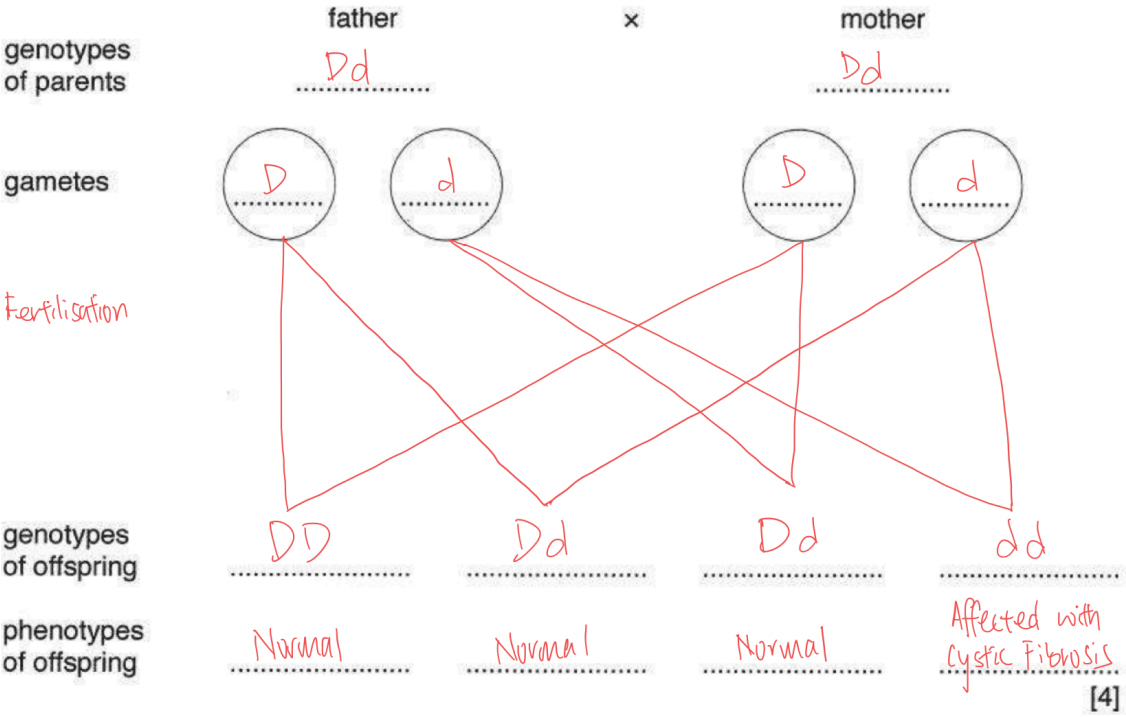
(c)

- In daylight, light energy is present for chloroplasts in plants to photosynthesise.
- Open stomata allow for more gaseous exchange, so more carbon dioxide diffuses into leaves, and is reduced into more glucose during photosynthesis.
- It also allows more oxygen, the by-product, to diffuse out.
- Open stomata increases transpiration rate, so more water is pulled up the xylem to the leaves replenish water used by photosynthesis.

Q4.

(a)

Use the symbol **D** for the dominant allele and **d** for the recessive allele.



[4]

(b)

- As fertilisation is a random process, the genotype of each child is based on chance/probability.
- The sample size of offspring is only 2, which is very small, hence the discrepancy of actual ratio from the expected ratio.

(c)

- A sudden change in the structure of a gene
- or chromosome number.

(d)

- The presence of a mutagen such as ultraviolet radiation/nuclear radiation/toxic chemicals/tar in cigarette smoke.

Q5.

(a)

(i)

- C C G A T A

(ii)

- Nucleotide

(b)

Social:

- This could reduce the cost of production of such medications and make them more affordable to people who need them
- Companies could set patents on the production process for such proteins, and make medicines very costly, financially exploiting those who need them.

Ethical (Choose 2):

- It could result in unforeseen health problems for the chickens, causing suffering for chickens which is morally wrong
- Morally wrong to violate animal rights, by using chickens as biological factories
- Can be seen as "playing God", some may feel it is morally wrong to modify living things.

Q6.

(a)

Choose 2:

- Energy is lost as heat to the surroundings due to cellular respiration.
- Chemical energy is also trapped within carbon compounds in undigested food waste that is egested, and in excreted substances such as urine.
- When an organism dies, chemical energy is also trapped in the uneaten parts, such as its bones.

(b)

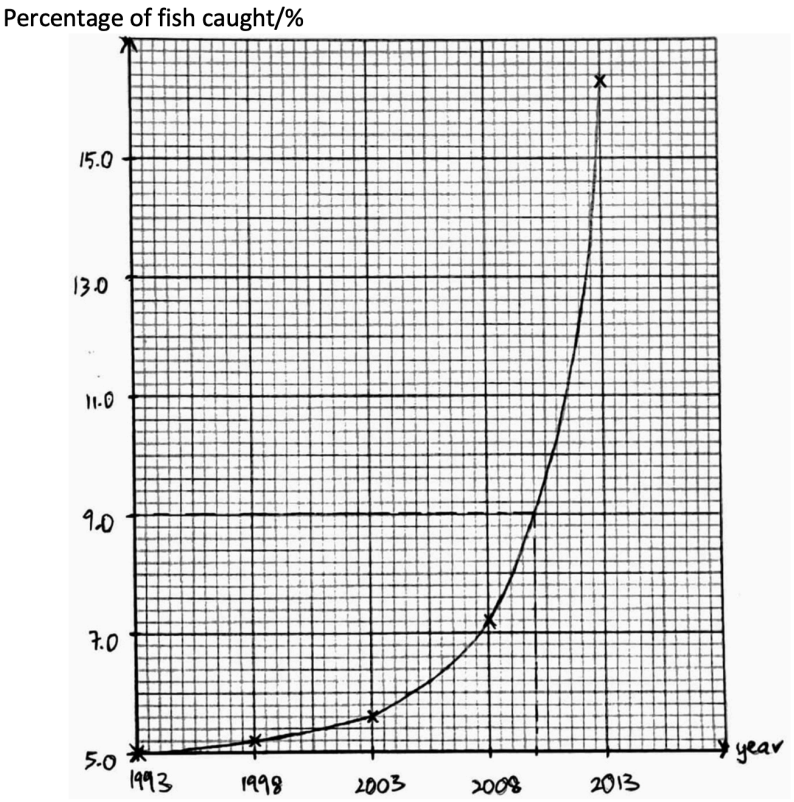
- (1600 – 90)/1600
  = 94% (nearest whole number)

(c)

- As 90% of energy is lost between each **trophic level**, such as during **aerobic respiration**, less and less energy is available for each increasing level of **consumer**.
- The energy that can be passed on to predators of tertiary consumers is extremely limited, hence it can only support very few of such predators.

Q7.

(a)(i)



(ii)

- (From graph working) – 9.0%

(b)

(i)

- From 1993 to 2003, percentage of fish caught with body lengths 40cm and longer gradually increases from 5.0% to 5.6%,
- Then increases more and more steeply until 16.3% at 2013.

(i)

- Having a large proportion of fish being 40cm and longer means that the fish are getting enough food to grow to that size or larger,
- So that means the ecosystem is able to sustain a large population of fish, and the area is a good place for fishing.

- It means a large proportion are adults, and they can reproduce and have offspring,
- ensuring the survival of the population and providing more fish to be caught in future.

Q8.

(a)

- During ultrafiltration, most of the blood plasma and dissolved substances are forced out of the glomerulus into the bowman's capsule by high (hydrostatic) blood pressure.
- During selective reabsorption, useful substances are absorbed from the filtrate back into the blood as they pass through the nephron.
- All glucose and amino acids are reabsorbed, while some mineral salts and some water is reabsorbed.
- The remaining filtrate in the collecting duct becomes urine which is later excreted out of the body.

(b)

- During kidney dialysis, blood is drawn from a vein in the patient's forearm and passed into a dialysis machine.
- It flows through a partially permeable tubing, which is bathed in dialysis fluid/dialysate
- The dialysate contains zero waste products, so the concentration gradient is as steep as possible, increasing diffusion rate of waste products out of blood.
- The dialysate contains the same concentration of useful substances such as glucose and amino acids as healthy blood, there is no concentration gradient, hence they do not diffuse out of the blood.
- The tubing is long, narrow and coiled, increasing the surface area to volume ratio for faster diffusion of waste substances out of blood.
- Blood flows in the opposite direction as the dialysate, so that a concentration gradient of waste products is maintained along the entire length of the tube, so more waste products diffuse out in one circuit.
- Cleaned blood is returned back to the vein in the patient's forearm.

Either Q9.

(a)

- When blood glucose rises above the norm, cells in the islets of Langerhans in the pancreas detect this, and secrete more insulin into the bloodstream.
- Insulin increases the permeability of cells in the liver and muscles to glucose so more glucose diffuses into them, and triggers conversion of glucose into glycogen.
- This lowers blood glucose back to normal, insulin secretion reduces back to normal.
- When blood glucose falls below the norm, cells in the islets of Langerhans detect this and secrete more glucagon into the bloodstream.
- Glucagon triggers the conversion of glycogen into glucose in liver cells, which is released to the bloodstream.
- This raises blood glucose back to normal, glucagon secretion reduces back to normal.

(b)

- In cold environments, the body loses heat and internal temperature decreases, which is detected by thermoreceptors in the hypothalamus, which sends nerve impulses triggering several responses.
- The rate of aerobic respiration by mitochondria increases, releasing more heat energy.
- Arterioles in the skin constrict, ~~shunt vessels dilate,~~ reducing bloodflow to capillaries near the skin surface, decreasing heat loss.
- Sweat glands secrete less sweat, less water in sweat evaporates, hence less latent heat is lost.
- Shivering, the rapid contraction of skeletal muscles, further releases more heat energy via aerobic respiration.

Or Q9.

(a)

- A specific substrate which is complementary to the active site of the enzyme binds to it,
- forming an enzyme-substrate complex.
- The enzyme then catalyses the reaction.
- After the reaction, the products are no longer complementary to the active site, hence they leave the active site.
- The enzyme remains chemically unchanged and can accept a new substrate.

(b)

- Enzymes break down large food molecules into small, soluble ones so that they can be absorbed into the bloodstream.
- Protein is broken down into short polypeptides by ~~pepsin~~ protease in the stomach, and ~~by trypsin in the~~ protease secreted by the pancreas in the small intestine.
- Short polypeptides are further broken down into amino acids by ~~peptidases~~ protease in the small intestine that is released by epithelial cells.
- Starch is broken down into maltose by salivary amylase in the mouth, and maltose is further broken down by maltase into glucose in the small intestine.
- Pancreatic lipase and intestinal lipase digest fats/triglycerides into glycerol and fatty acids.