Credit: Written by the collective effort of our tutors at ThatBioTutor. You are welcome to share these with anyone you'd like! Just don't sell them for profit :)

TYS Answers 2021 (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	C	21	A
2	B	22	A
3	D	23	D
4	D	24	D
5	A	25	D
6	D	26	C
~~7~~*	~~C~~	27	B
8	A	28	C
9	D	29	C
10	A	30	C
11	B	31	B
12	A	32	C
13	B	33	C
~~14~~*	~~B~~	34	B
15	A	35	A
16	D	36	C
17	C	37	D
18	A	38	B
19	C	39	A
20	D	40	D

**Q7: "Breaks down old red blood cells" is now a function of the liver that is out of syllabus.*
**Q14: Carbonic Anhydrase out of syllabus, they are not produced by white blood cells.*

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Q1.

(a)

- P: Vena cava
- Q: Right atrium

(b)

- Coronary arteries branch from the aorta, bringing oxygenated blood to the heart muscles,
- Supplying them richly with oxygen and nutrients for aerobic respiration to carry out muscular contractions needed to keep pumping blood.

(c)

- At the lungs, oxygen diffuses into blood capillaries from alveolar air spaces,
- and is brought in the blood to the heart's left atrium via the pulmonary vein,
- then moves into the left ventricle past the bicuspid valve.
- It is pumped past the aortic semi-lunar valve into the aorta, then travels to the kidneys via the renal arteries.

(d)

- ~~*When blood vessels are damaged, damaged tissues and platelets release thrombokinase, which converts prothrombin to thrombin in the presence of calcium ions.*~~
- ~~*Thrombin converts fibrinogen to fibrin, forming insoluble fibrin threads that trap red blood cells, forming a clot at the site of injury.*~~
- When blood vessels are damaged, **platelets** are activated, which trigger the conversion of **soluble fibrinogen** into **insoluble fibrin**,
- Forming **long insoluble Fibrin threads** which trap **red blood cells**, forming a **clot** at the site of injury.

Q2.

(a)

**Note: Question background info said that the width of arrows represent amount of energy. 25 au for death and excretion = 10 small squares. 1 small square = 2.5au*

(i)

- 6 x 2.5au = 15au

(ii)

- Heat

(iii)

- 20 x 2.5au = 50au. OR:
- 90au - 15au - 25au = 50 au.

(b)

- 15au/90au x 100% = 16.7% (3 s.f.)

(c)

- A lot of energy, 50/90au = 55.6% is lost as heat. By restricting movement, animals engage in less muscular contractions,
- Lowering the demand for aerobic respiration, so less energy is lost as heat.
- More than 16.7% of energy would now be available for growth, the animals will grow to full size faster, increasing productivity of the farm.

Q3.

(a)

- B: Salivary amylase
- C: Pancreatic lipase/Pancreatic amylase/Protease ~~*Trypsin*~~/~~*Sucrase*~~/Maltase/~~*Peptidase*~~/~~*Lactase*~~/Intestinal Lipase/
- A: Protease ~~*Pepsin*~~

(b)

- Various molecules in food are the specific substrates, which are complementary to their respective digestive enzymes, and bind to their active sites.
- The enzymes catalyse the reactions, after which, the products are no longer complementary to the active site, hence they leave,
- And the enzymes remains chemically unchanged and can accept new substrates.

Q4.

(a)

	father	x	mother
genotypes of parents	Nn		Nn
gametes	N, n		N, n
genotypes of offspring	NN, Nn		Nn, nn
phenotypes of offspring	Unaffected, Unaffected		Unaffected, Affected

(b)

- 1 in 4 chance/25%.

(c)

- In the placenta, any excess phenylalanine in the foetus' blood diffuses into the mother's blood vessels, and is later broken down by the mother.
- Hence during pregnancy, the foetus' blood will not have a build-up of phenylalanine, hence will not show symptoms PKU.

(d)

- Down Syndrome.

Q5.

(a)

- The process whereby toxic substances and metabolic waste products are removed from the body,
- ~~*Preventing it from accumulating to toxic levels and interfering with metabolic reactions.*~~
- They must be excreted as they can harm the body if they are allowed to accumulate to high concentrations.

(b)

(i)(ii)

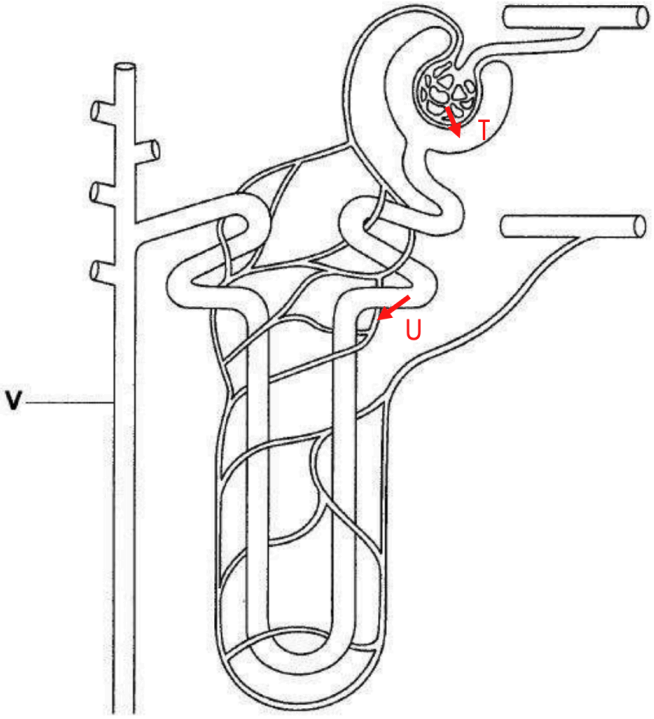

Fig. 5.1

(c)

- V is the collecting duct. More ADH in the blood increases the permeability of the cells of the wall of V to water.
- This increases the amount of water reabsorbed from the filtrate back into the bloodstream, increasing urine concentration.

(d)

(i)

- Both dialysis fluid and blood plasma contain useful substances such as glucose, mineral salts and amino acids.
- Blood plasma contains blood proteins such as ~~*prothrombin and*~~ fibrinogen, while the dialysis fluid does not.

- Blood plasma contains metabolic waste products such as urea, while the dialysis fluid does not.

(ii)

- As the dialysis fluid has zero waste products, a concentration gradient exists between blood and dialysis fluid.
- As blood passes through the dialysis machine, waste products such as urea diffuse out from blood to the dialysis fluid, so that cleaned blood is returned to the patient.

Q6.

- A restriction enzyme is used to cut a section of DNA containing the human insulin gene, creating sticky ends.
- The same restriction enzyme is used to cut a plasmid, creating sticky ends.
- Plasmid and target gene are mixed, allowing them to anneal via complementary base pairing at the sticky ends.
- DNA Ligase is added to seal them together, resulting in a recombinant plasmid.
- Mix this with bacteria, and heat shock/electric shock treatment is applied, creating pores in the bacteria's plasma membrane to allow the recombinant plasmid to enter.
- The transgenic bacteria will then produce insulin as part of their metabolic processes.

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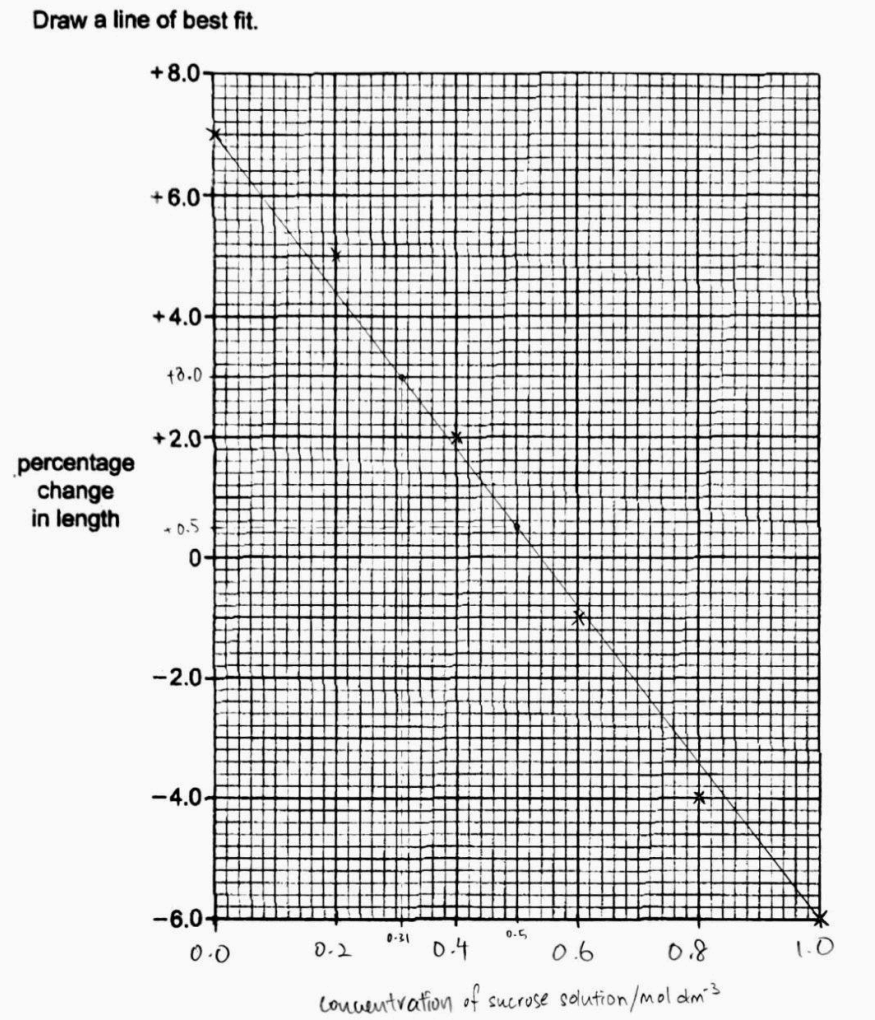
Q7.

(a)(i)



(ii)

- 0.31 mol dm^{-3}

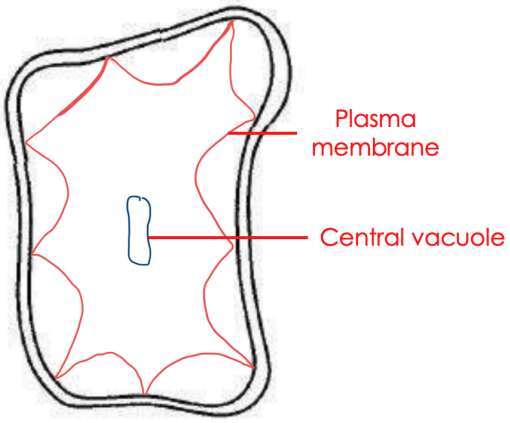
(iii)

- +0.5%

(b)

- As the concentration of sucrose solution potato strips are placed in increase from 0.0 to 1.0mol dm^{-3}, percentage change in length decreases from +7.0% to -6.0%.
- When placed in solutions with higher water potential than that of the potato cells, water moves in by osmosis down the concentration gradient, making the cells expand and more turgid, increasing size of the strip.
- When placed in solutions with lower water potential than that of the potato cells, water exits cells by osmosis, the cells become flaccid, hence the strip shrinks.

(c)
Draw: Blue (central vacuole) OR Red (plasma membrane)



Q8.

(a)

Structure 1:~~Hair~~
Explanation: ~~Hairs stand up due to contraction of hair erector muscles, trapping a layer of air, which is a poor conductor of heat, reducing heat loss to the surrounding.~~

Structure 2: Thermoreceptor/Nerve ending
Explanation: Detects the cold skin temperature, generating nerve impulses which are sent along the sensory neurone.

Structure 3: Sensory neurone
Explanation: Carries nerve impulses which will travel towards the hypothalamus, which will trigger corrective mechanisms to raise body temperature.

Structure 4: Fatty/Adipose tissue
Explanation: Fats are a poor conductor of heat, reducing heat loss to the environment.

Structure 5: Blood capillaries
Explanation: Less blood flows in them when body temperature is too cold, reducing heat loss.

(b)

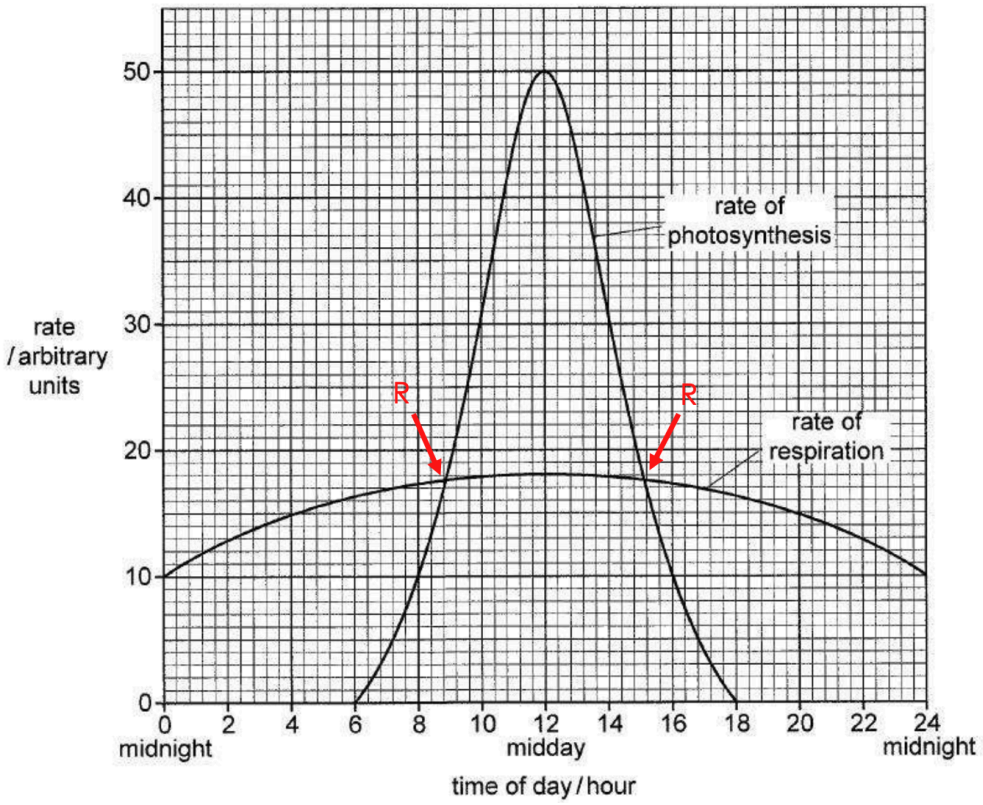
- Homeostasis is the maintenance of a constant internal environment.
- Changes in internal environment act as the stimulus, triggering responses to counteract the change, returning the internal environment back to set-point, via negative feedback.

(c)

- Changes in internal temperature are the stimulus, detected by thermoreceptors in hypothalamus, which is the control centre.
- Hypothalamus sends nerve impulses to effectors such as arterioles in skin, sweat glands and skeletal muscles that carry out corrective mechanisms to counteract the change in temperature.
- Once set-point is restored, thermoreceptors in hypothalamus detect this, the hypothalamus then sends nerve impulses to stop the corrective mechanisms.

Either Q9.

(a) Choose 1 arrow:



(b)

- From 0 to 6 hours, photosynthesis rate stays at 0 units as the sun has not risen yet, and there is no sunlight for chlorophyll to absorb and convert into light energy.
- From 6 to 12 hours, rate increases from 0 sharply to 50 units, as the sun rises and the light intensity peaks at noon where the sun is directly overhead.
- From 12 to 18 hours, rate decreases symmetrically from 50 to 0 units, as the sun is setting and light intensity decreases,
- Until 18 hours where the sun has set and it is night. No daylight is present from 18 to 24 hours, hence no photosynthesis occurs.

(c)

- Despite photosynthesis having a higher peak rate of 50 units, compared to respiration's peak rate of 18 units,
- Photosynthesis only occurs from for 12 hours, while respiration occurs through the entire day, such that total photosynthesis matches total respiration per day.
- An equal amount of glucose made during photosynthesis is broken down back into carbon dioxide during respiration.
- There is no net gain of glucose to be used in building new cell parts such as cellulose cell walls for growth, hence the plant's mass remains the same.

Or Q9.

(a)

- One of the ovaries release a mature ovum each month during ovulation, to allow for the possibility of fertilisation.
- The ovaries secrete sex hormones, including oestrogen which repairs and thickens the uterine lining,
- And progesterone which maintains and further thickens the uterine lining, and causes growth of more blood vessels within it.

(b)

Similarities:

- For both, progesterone has a consistent presence throughout the 9 months.

Differences:

- The pregnant woman's progesterone increases from 25 units in months 0-1 to 250 units in months 8-9, but a non-pregnant woman would reach the same levels every month.
- The non-pregnant woman would have a lower level than the pregnant woman's first month of 25 units, throughout the 9 months.
- The pregnant woman's progesterone levels sometimes decrease from the previous month's, such as from months 4-5 to 5-6, and 6-7 to 7-8. A non-pregnant woman will not have this, she would reach the same level every month.

(c)

- After pollination, the stigma produces a sugary fluid, stimulating the pollen grain to germinate.
- A pollen tube grows from the pollen grain, secreting enzymes to digest a path through the stigma, style and ovary wall.
- Pollen tube enters an ovule via the micropyle.
- The pollen tube absorbs sap and bursts, releasing a male sex nucleus ~~*two male sex nuclei, one of which will fuse*~~, which fuses with the ovum, forming a diploid zygote.