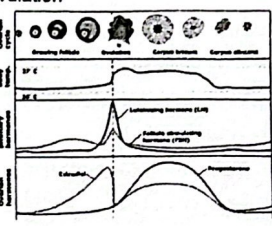
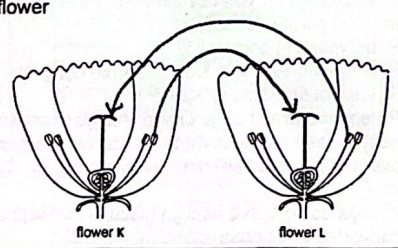


Section A

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

Section B			
Qn	Answer	Marks	Remarks
1(a)	C – sweat gland D – adipose/fatty tissue/layer	1 1	For C R: blood vessel For D Reject: fat (it is not a structure) R: fatty deposits R: muscle
1(b)	- less food eaten / less fat in diet / exercise more - so fat used by body to release energy/energy source ; body using more energy than it is taking in *student who elaborated about how fats in adipose tissues are burned to generate heat --> .will only be awarded the mark if they explain about cold winter(change over several months). [1 mark]	1 1	Pt 1: A: vigorous activities like exercising/ increase in physical activity / person is fasting R: decrease in body fat % R: layer decreases to lose heat from body R: Lack of nutrients (vague) R: temperature change due to change in seasons/ trap heat to keep us warm /hot weather, decrease to prevent overheating or fat will melt due to heat. Pt 2 A: cells do not have enough glucose for respiration. / Fats converted to glucose R: insufficient energy to use therefore thickness decrease.
1(c)	- A: is a receptor (touch / pressure / pain / temperature) / nerve ending - examples of uneven distribution e.g. high density in fingers / lips/ toes / face - exposed areas + need higher sensitivity	1 1 1	A: sensory neurone /sensory receptors R: Sweat glands R: high density – hands (palm vs back of hands) R: less thermoreceptors in elbow *some areas in the skin that are low in sensitivity e.g. elbow have few pain receptors – more likely to be injured /knocked up etc.
1(d)	- vasoconstriction OR blood vessels / arterioles / arteries / part B + narrow / constrict; - less blood flows in blood vessel / to surface of skin - decrease in radiation / heat loss	1 1 1	Awarded ECF if student read the qn as increase in temperature and describe about the reverse. R: B produces less sweat R: Shivering (nothing to do with blood vessels)

2(a)	- the patch releases high concentration of oestrogen and progesterone / hormones. - which diffuses from the (medicine reservoir) patch into the layers in the skin till it reaches the blood vessels, and it is transported around the body via the blood. - In the ovaries, the hormones (progesterone) prevent follicles from developing in the ovaries / inhibit ovulation - without mature egg cells, there will be no fertilisation so preventing pregnancy	1 1 1 1	A: higher conc in the patch to lower concentration in the blood vessels. R: hormones diffuse out of the blood into the patch. R: O&P causes the shedding of uterine lining preventing implantation. R: ovaries are discharged / sperm will not be able to fertilise ovaries. Many students did not state pt 1 & 2 oestrogen makes the mucus in your cervix thicker → this prevents the sperm from reaching the uterus and fallopian tubes, where they could find an egg. Combination of oestrogen and progesterone → suppresses ovulation 
2(b)	Patch Pro- it is easy to use / administer, and the user can stop any time - elaboration . Con- it needs to be regularly replaced if not the hormone levels will drop and no longer effective/ be able to prevent ovulation. Implant	1 1 1	A: patch may falls off easily A: implant; need a surgery to remove it if the couple will want to have children A: patch- limited capacity of the medicine reservoir R: need to change patch weekly (from qn stem) R: patch is costly as need to change it frequently (not as much as implant)

	Pro- Can last longer up to 5 years and will continuously release hormones ensuring prevention of ovulation/ pregnancy . Con- Will need a doctor to administer, not readily available off the shelves.	1	R: implants- couples cannot do anything if they change their mind. R: implant – requires expensive medical procedure/surgery. R: answers the at describe collectively about implants and patches- e.g. both prevent pregnancy. No guarantee it will prevent pregnancy.
3 (a)	Any 1 : Line from the anther of one flower to stigma of another flower 	1	
3 (b)	Anthers are lower than the stigma. the pollen grains are less likely to fall from the anther to the stigma of the same flower. R: They mature at different times	1 1	A: stigma above anthers. R: for large petals- to attract insects/easy entry for insects R: reduce chance of self pollination without elaboration. R: both flowers are bisexual. R: Petals are present (no elaboration)
3 (c)	- large petals [1] → provide landing platform for insects. [1] - stamens / anthers / filaments/ stigma inside flower / short style, inside flower or short, stamens / filaments or small anthers[1] as these need not be exposed to the wind[1] OR so that it can catch the pollen grains as insects brush pass.[1] - stigma, broad / wide / not feathery[1] as need not provide large surface area to catch pollen blown by the wind [1] Must provide justification for feature. Reject nectar guide, colourful petals	Max 2	R: Large petals: to attract insects

3 (d) (i)	- asexual reproduction; - which produces new plants which are genetically identical / no fusion of nucleus of male gamete with nucleus of female gamete to form zygote/ offspring grow by mitosis ;	1 1	Reject not genetically dissimilar and genetically similar A: one parent is involved + identical cells produced R: one parent (only- One parent can also lead to sexual reproduction in the case of self-pollinated flowers) R: Requires more energy than sexual reproduction R: Propagation / cutting R: Mitosis (qn not asking about type of cell division) R: natural selection cannot occur If student identified it as e.g mitosis but explanation is about asexual, mark was still awarded.
3 (d) (ii)	- competition for resources as all individuals are close together if grown in same pot; - increased risk of inheriting harmful, alleles / features / trait susceptible to the same diseases as parent. no / little, genetic variation so less adaptive to changes in environment; susceptible to the same diseases as parent; Reject: recessive alleles not expressed	1 1 1 Max 2	R: offspring will only inherit beneficial trait from one parent. R: pass down all its weakness (vague) A: all undesirable traits passed down to offspring
3(e)	- Mutant / changed enzyme has a different shape/ structure of active site where - substrate cannot fit into active site / no longer complementary / enzyme-substrate complexes cannot form/ enzyme can no longer carry out reaction.	1 1	Mutation causes change in sequence of DNA / gene /base sequence that codes for protein forming the required enzyme resulting in production of a different protein / polypeptide / enzyme/sequence of amino acids R: lose its active site (vague) /cause change to active site (no shape/ structure)/ R: even if mention change in sequence of nucleotide, need to elaborate that the structure of active site changed. R: mutation – produces different amino acids / active site may be mutated

			R: enzyme cannot bind to amino acid (no mention about active site / ES complex)
4 (a)	rises / expands	1	A: chest will move upwards
4 (b)	Any 2: - Lower concentration of oxygen - Higher concentration of carbon dioxide - Higher concentration of water vapour	1 1 1 Max 2	R: air has little or no nitrogen. R: Air is warmer (Qn asked abt conc of gases) R:
4 (c) (i)	- Oxygen from air forced into the lungs (alveoli / air sacs) and binds reversibly with haemoglobin in red blood cells - Oxygen can diffuse from a region of higher to low concentration / down concentration gradient to tissues/ oxygen poor regions.	1 1	R: Aerobic respiration to take place R: allow air/oxygen to be transported around body (only) R: Carry oxygen to muscles and tissues (only) R: removes CO2 (qn talks about air being forced in.. not out). A: Allow oxygen to diffuse into the bloodstream via the alveoli.
4 (c) (ii)	- With each compression on the chest, blood is forced/ pushed out from the left ventricle/ heart to the tissues and organs AND - Allowing aerobic respiration to take place - Allows the heart muscles to start contracting again.	1 1 1 Max 2	A: Allow the heart to start pumping again (Pt3) A: helps the heart to pump/ Allow the heart to circulate blood around the body. (Pt1) A: cellular respiration (Pt2) R: Changes in pressure in lungs for gaseous exchange R: Stimulates the heart to pump at <u>a faster rate</u> .
5(a)	A: Aorta B: Pulmonary vein	1 1	For A R: Arterioles For B R: Pulmonary artery/ Aorta
5(b)	Part C /valve prevents backflow of blood from the pulmonary artery to right ventricle	1	*Minimum need to say right ventricle / ventricle. R: right atrium.
5 (c)	Deoxygenated blood flows from the rest of the body via venae cavae to right atrium	1 1	R: no mention of 'right atrium/ventricle contracts'. R: pulmonary artery contracts

	- Right atrium contracts, generating higher pressure in the atrium than ventricle, leading to the opening of the tricuspid valve and blood is forced into the right ventricle. - The right ventricle contracts, generating higher pressure in the ventricle than the pulmonary artery, leading to the opening the semi-lunar valves and blood is forced into the pulmonary artery. Pulmonary artery carries deoxygenated blood from the heart to lungs.	1 1	R: Order of blood flow wrong E.g aorta to ventricle to atrium R: constriction (instead of contraction)
6(a)	- Once food enters the mouth, nerve impulses were sent to the stomach and volume of gastric juices peaked within 0.5 hours as nervous control is faster as signals are sent via nerve impulses in neurones (A). - As food enters the stomach, gastric juices increase after 2 hours, as hormonal control is slower as hormones travel by blood to the target organs (C). - The effect of nervous control (A) is short lived as it lasted only for a duration of 1.25 hours. - The effect of hormonal control (C) lasted for a longer duration of 4 hours. When digestion in the stomach is completed, the volume of gastric juice in the stomach decreases.	1 1 1 1	Pt 3: some students quoted wrong values. Quoted 1.5 instead of 1.25. Many students omitted 'neurones' and 'hormones transported in blood'. A: the action of nervous control stimulated a greater volume of gastric juice as compared to hormonal control. A: nervous control produces large quantities of gastric juices in a short amount of time but hormonal control produces lesser gastric juices in a longer amount of time (1mark) A: nervous control faster but effects short lived + hormonal control slower but longer lived (1 mark – no data)
6(b)	- The taste receptors are stimulated in the presence of food. Nerve impulses are produced and transmitted by the sensory neurone across a synapse to the relay neurone in the central nervous system/ spinal cord. - The nerve impulses are transmitted by the relay neurone across another synapse to the motor neurone.	1 1 1 1	A: taste receptors - sensory organ / tongue R: mouth is taste receptor. R: motor neurone which is the gastric gland Many did not describe 'taste receptor'. Many left out 'effector' and 'gastric gland'. R: signals instead of nerve impulses. R: stomach muscles produce gastric glands

	The nerve impulses are transmitted to the effector, which are the gastric glands in the stomach. The gastric glands in the stomach produces gastric juices to digest the food.											
7 (a)	mutation is a change in the structure /sequence of a gene or in the chromosome number	1	need to mention about both gene and chromosome number. A: structure of DNA A: structure of gene									
7 (b)	- Since John has polydactyly, he has inherited at least 1 dominant polydactyly allele from mother. - However, since his father does not have extra fingers, his father must be homozygous recessive. John must have inherited a recessive polydactyly allele from his father. Thus John must be heterozygous ;	1 1	R: using gene instead of allele. R: healthy allele									
7 (c)	<table border="1"><tr><td></td><td>T</td><td>t</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr></table> 50%		T	t	t	Tt	tt	t	Tt	tt		R: Punnet square without table drawn. R: Gametes crosses without lines/arrows
	T	t										
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Section B			
9 (a)	- A vaccine contains an agent that resembles a pathogen Prevents Infectious diseases by stimulating white blood cells to quickly produce antibodies when the pathogen invades.	1 1	Many stated 'virus' instead of 'pathogen'. R: vaccine contains antibodies.
9 (b)	- When viral protein is present in the bloodstream, they stimulate lymphocytes to produce antibodies against it. Antibodies may stay in the blood /plasma for some time / when exposed to the virus, the same antibodies are produced readily. - Since antibodies can diffuse from the mother's blood into the foetal blood across the placenta, the antibodies also protect the foetus. Any 2 of the following: - The antibodies destroy the virus by attaching to them and causing the surface membrane to rupture OR attaching to viruses, making them unable to bind to the host cell. - The antibodies also cause the virus to clump together/agglutinate so that they are easily ingested by phagocytes. - The antibodies neutralizing the toxins produced (act as anti-toxins)	1 1 1 1 1 1 Max 4	Pt 1: many did not state 'lymphocytes'. A: memory cells remain in the blood R: memory cells/ mothers blood can transferred to the foetus via umbilical vein. R: phagocytes engulf the vaccine.
9 (c)	Prescription of antibiotics when it is not required E.g. viral infection Explanation - Antibiotics will not kill viruses/ not effective against viruses - will kill off the normal bacteria flora found on the body giving rise to increase risk of bacterial infections. OR	1 1 1	

	- Users do not complete the course of the antibiotics. Explanation - Bacteria causing the infection will not be entirely killed off, may develop mutations that result it becoming resistant to the antibiotics.	1 1 Max 4	
10 a)	- From 0 to 2s, curvature of lens is increasing from 1.00 arbitrary units to 3.80 arbitrary units - as the object is moving towards/ nearer to Jovan. - The ciliary muscles contract and suspensory ligaments slacken. - From 2 to 4s, the curvature of lens remain constant at 3.8 arbitrary units - as object remains stationary/ is not moving.	1 1 1 1 1	R: curvature increases from 1-3.8 au, from 0-4s. R: suspensory ligaments relax
10(b)(i)	- Carbon sink: - an area that stores carbon compounds for an indefinite period and stores more carbon than it releases ; - Ocean: - carbon dioxide dissolves in oceans' water and is absorbed/used by algae/phytoplankton in photosynthesis; - carbon compounds buried deep under sea bed form fossil fuels/natural gas and oil	1 1 1	R: stores large amount of carbon
10(b)(ii)	- Do not touch the reefs. - Do not use sunscreen when diving. - Do not buy live corals. - Do not pollute the coasts with plastic.	1 1 1 1 Max 2	R: use less electricity/ lower carbon footprint (vague)/ use fan instead of aircon R: take public transport R: do not release sewage into the ocean. R: Do not go coral diving. R: use renewable bags instead of plastic bags. A: do not take corals out of the ocean. A: do not support companies that pollute the ocean by dumping sewage /harm corals. A: Limit admission of individuals into coral reefs. A: spread awareness about the importance of coral reefs.

7 (d)	father: $I^A I^B$ mother: $I^O I^O$ parental genotype gametes: I^A I^B I^O I^O offspring genotype: $I^A I^O$ $I^A I^O$ $I^B I^O$ $I^B I^O$ offspring phenotype: Blood type A Blood type A Blood type B Blood type B	4	R: $I^O I^B$ (Order) R: Genotype – AB / O R: Phenotype – A, B. Missing 'type'
8 (a)			- Both scales must be in 1 decimal place. Common Errors: Swapped axis Extrapolation of line

8 (b)	- The closer the distance of the fan from the plant the higher the wind speed / the further the fan from the plant the lower the wind speed. - Wind will blow away the accumulated water vapour on the underside of the leaves, causing the water vapour concentration outside the leaves to drop. - This causes more water vapour to diffuse out of the leaves via the stomata (from a region of higher concentration) to the surrounding air (to a region of lower concentration). / increases the rate of transpiration. - This results in more water to be taken by up the plant shoot, causing the air bubble to move a greater distance (closer distance of fan from plant) / lesser distance (further distance of fan from plant).	1 1 1 1	If transpiration is missing from (b) or (c) -1 mark A: wind intensity R: wind is stronger /less or more air blown at plant R: diffusion gradient Many did not understand and explain with the concept of 'water vapour diffusing out of stomata'. Poorly answered.
8(c)	- Overall trend would be the same, but the distance moved by the air bubble will be shorter. - At higher humidity, the concentration gradient between the intercellular air spaces and the surrounding air is less steep, thus less water loss via transpiration.	1 1	Many did not state pt 2. Many students did not mention about the trend Some students confuse temp vs humidity Some do not understand humidity and its effect