

Paper 2 Section A

Marks

1. (a) (i) • all glucose filtered in the kidney tubules is reabsorbed into the blood (1)  
• (1)  
because it is reabsorbed by means of active transport (1) (4)  
• however, only half of the urea is reabsorbed back into the blood (1)  
• as urea is reabsorbed by means of diffusion only (1)
- (ii) (1) • as most of the substances in the glomerular filtrate are reabsorbed into the blood (1)  
• the water potential of blood is much lower than the remaining fluid in the kidney tubules (1) (3)  
• hence, there is a net flow of water from the filtrate in the kidney tubules to the blood in the blood capillaries by osmosis (1)
- (2) • antidiuretic hormone / ADH (1)  
• it increases the permeability of the collecting duct to water (1) (2)  
so more water will be reabsorbed
- (b) (i) • left ventricle (1) (1)
- (ii) • venous return determines the volume of blood available inside the ventricle (1)  
• while the strength of contraction determines the amount of blood pumped out (1) (2)
- (iii) • contraction of skeletal muscles especially in the limbs squeezes the veins (1)  
• increasing the blood flow from veins (1)  
• thus, more blood is returning to the heart via the vena cava (1) (3)  
Or  
• breathing depth increases during exercise (1)  
• the thoracic pressure becomes more negative (1)  
• to assist the upward movement of blood along the vena cava (1)
- (iv) • because marathon runners have to run a long distance than 100 m runners, their muscles need to sustain contractions for a longer time (1)  
• if they run at the speed of 100 m race, the oxygen supply to muscles will be insufficient (1) (5)  
• muscles will carry out anaerobic respiration (1) to produce lactic acid  
• as a result, lactic acid accumulates in the muscles (1)  
• leading to muscle fatigue (1), i.e. the muscles fail to contract any more

**Paper 2 Section B**

Marks

2. (a) (i) (1) • concentration of pesticide at which 50% of the crustaceans are killed:  
A:  $42 \mu\text{g L}^{-1}$  (1)  
B:  $27 \mu\text{g L}^{-1}$
- (2) • as the 50% mortality occurs at a lower concentration of B than A (1)  
• showing that pesticide B is more toxic (1) (2)
- (ii) (1) • pesticide B is more readily absorbed than pesticide A (1)  
• pesticide B is less readily excreted than pesticide A (1)  
• pesticide B is less readily degradable / metabolized / broken down than pesticide A (1) (3)
- (2) • to ensure no mortality is observed throughout the experiment (1) (1)
- (iii) • carnivorous fish is expected to have a higher concentration of pesticide A than herbivorous fish (1)  
• because carnivores occupy a higher trophic level than herbivores (1) / carnivorous fish has a higher trophic level than herbivorous fish (3)  
• animals at a higher trophic level accumulated more pesticides when they feed on organisms at lower trophic levels / animals at a higher trophic level accumulated more pesticides along the food chain (1)
- (b) (i) • location A (1)  
• highest percentage cover by live corals and lowest percentage of dead corals (1) (2)
- (ii) (1) • sewage discharge from farms (1)  
• release large amount of inorganic nutrients including  $\text{NO}_3^-$  /  $\text{PO}_4^-$  (1) which favour / induce fast growth of seaweeds (1) (3)
- (2) • the seawater is polluted and no longer suitable for growth of corals / seaweed outcompete corals for space or light / seaweed produced toxic substances that kill corals (1) (1)
- (iii) (1) • corals provide shelters (1)  
• and food sources for other marine organisms (1) } any two points (1,1)  
• and breeding ground for other marine organisms (1)  
• which attracts many other marine species to settle there (1) (1)
- (2) • destructive fishing such as trawling / yachting / water skiing (1) (1)  
(accept other reasonable answers)

Paper 2 Section C

Marks

3. (a) (i) • *E. coli* is normally found in the faeces / intestine of humans / warm-blooded animals (1)  
• its abundance in water reflects whether the water is polluted with faecal matter / faecal microbes (1)  
• which potentially/may contain faecal pathogens (1) (3)
- (ii) • Deep Water Bay Beach (1)  
• as it shows the lowest *E. coli* count (1)  
• i.e. less polluted (1) by faeces (3)
- (iii) • it fails to indicate the level of pollution other than faecal contamination (e.g. chemical pollution) / microbes associated with other types of pollution (1)  
• the count may not always relate to the density of pathogens (1) due to different survival rates of *E. coli* and the pathogens (2)
- (iv) (1) • to avoid the contamination of the culture by microbial sources other than the water sample / ensure that only microbes of water samples are cultivated (1)  
or (1)  
• protect lab personnel from contamination by the microbes / pathogens present in the water sample (1)
- (2) • sterilize the culture media in an autoclave (1)  
• high temperature and pressure (1) of the autoclave (3)  
• will kill bacteria and fungi and their spores (1)
- (b) (i) • different environmental factors favour the growth of different microbes (1)  
• the diversity of microbes entering the milk varies with season (1)  
• different species of microorganisms may produce different types of metabolites (1) and thus affects the flavours of the cheese (3)
- Or
- each enzyme works under an optimum range of environmental conditions (1)  
• the metabolism (not acceptable: activity) of microbes varies with season / environmental factors (1)  
• microbes may produce different types /compositions of metabolites in different seasons (1) and thus affects the flavours of the cheese
- (ii) (1) • process (I) kills pre-existing microorganisms (1) that may affect the quality of the cheese  
• process (II) ensures that only the desired metabolites will be produced (1) by the added microbes, thus giving the particular taste / flavour / texture / quality desired (2)
- (2) • the punching of holes allows air / oxygen to diffuse /flow into the cheese (1)  
• so that the fungus can carry out aerobic respiration (1) to provide energy (3)  
• for the growth of hyphae and formation of spores (1) throughout the cheese (alternative: growth and reproduction)

**Paper 2 Section D**

Marks

4. (a) (i) • selective breeding involves sexual reproduction / fusion of gametes (1)  
• which produces offspring with genetic variations (1)  
• as a result, the desirable traits may be diluted (1) / desirable traits may not appear / undesirable traits may appear (5)  
• however, the organisms produced from cloning are developed from mitosis of the cells from desired donor (1)  
• the organisms produced are genetically identical to the donors (1), so all the desirable traits will be preserved
- (ii) (1) • as only individuals with desirable traits were selected for breeding while others were not perpetuated (1),  
• the genes for the undesirable traits will be eliminated from the gene pool eventually (1) / the gene frequency of the desirable traits will increase / undesirable traits will decrease (2)
- (2) • the desirable genes may be taken from a different species (1) / may not naturally occur in the organisms to be transformed  
• as a result, new genes will be added to the gene pool of a species (1) (3)  
• this may produce superior species and pose threats to other species / the long term effect is not yet known / this may create new species artificially (1)
- (b) (i) • No. of restriction sites in the DNA fragment with normal allele: 3 (1)  
No. of restriction sites in the DNA fragment with mutated allele: 2
- (ii) • after cutting with the restriction enzymes, two short DNA fragments will be produced from the DNA fragment with normal allele (1)  
• and one long DNA fragments will be produced from the DNA fragment with the mutated allele (1) (4)  
• as the DNA fragments will migrate to the (positive) pole in gel electrophoresis (1)  
• DNA fragments with shorter lengths will migrate faster than those with longer length (1), forming separate bands on the gel
- (iii) • three DNA bands (1)  
• as the person has both the normal allele and the mutated allele (1) / is a heterozygote (2)
- (iv) • change in a nucleotide in the base sequence may lead to a change in the triplet code (1)  
• thus may change the amino acid sequence of the protein produced (1) (3)  
• as a result, the protein produced may fold to a different shape (1) and lose its function