

Paper 2 Section A

Marks

1. (a) (i) • motor area of the cerebrum (1) (1)
- (ii) (1) • high / increased concentration of carbon dioxide in blood (1)  
• when she held her breath in water, the body cells continued to produce carbon dioxide through respiration (1) (3)  
• however, the carbon dioxide could not be excreted through exhalation during the breath holding (1)  
as a result, carbon dioxide accumulated in the blood
- (2) • the high concentration of carbon dioxide was detected by the chemoreceptors at medulla / carotid body / aortic arch (1)  
• this, in turn, stimulated the respiratory centre in the medulla (1) (4)  
• more nerve impulses were then sent to the respiratory muscles (i.e. intercostal muscles and diaphragm muscles) (1)  
• the respiratory muscles contracted faster and more powerfully (1)
- (iii) • vasoconstriction of arterioles in her skin occurs (1)  
• this reduces blood flow to the skin surface (1), thus lower skin temperature  
• to reduce heat loss to the surrounding / to conserve core body temperature (1) (3)
- Or
- shivering (1)
  - the respiration rate of muscle increases (1)
  - to produce more heat (1) to increase body temperature
- (b) (i) • useful solutes, e.g. glucose, sodium ion, amino acids, are reabsorbed back into the capillary by active transport along the first coiled tubule (1)  
• hence, water potential of the blood surrounding the tubule decreases / water potential of the filtrate increases (1)  
• as a result, water moves out of the first coiled tubule along the water potential gradient by osmosis / water molecules move along with solutes (1) (4)  
• the amount of water reabsorbed is proportional to the amount of solutes reabsorbed (1)  
hence, solute concentration remains the same as the fluid flow from point A to point B
- (ii) • fluid at point D without ADH has a lower solute concentration than that with ADH (1)  
• ADH increases the permeability of the second coiled tubule and the collection duct (D) to water (1) (3)  
• as a result, a larger proportion of water is reabsorbed (1), resulting in a higher solute concentration
- (iii) • glomerulus (1)  
• the wall of glomerulus is impermeable to plasma protein / protein molecules are too large to pass through the wall of glomerulus (1) (2)  
if protein is present in the kidney tubule, it is most likely that the wall of glomerulus is damaged

Paper 2 Section B

		<u>Marks</u>
2. (a) (i)	<ul style="list-style-type: none"><li>• stir up sediments or pollutants at sea bottom / turbidity of water increases (1)</li><li>• destruction of habitats / shelters / breeding grounds at sea bottom (1)</li></ul>	(2)
(ii) (1)	<ul style="list-style-type: none"><li>• sites A and C &gt; sites B and E &gt; sites D and F (1)</li><li>• this shows that the closer the site to the protected area, the higher the animal biomass / the further the site to the protected area, the lower the animal biomass (1)</li></ul>	(2)
(2)	<ul style="list-style-type: none"><li>• protected area is undisturbed by fishing, thus providing a breeding ground for marine animals / at non-protected area, fish or marine animals are constantly caught (1)</li><li>• therefore, the marine protected area has more food resources as indicated by the highest animal biomass at sites A and C (1)</li><li>• some of them have migrated to the adjacent area (1), resulting in higher animal biomass in sites B and E than that sites D and F</li></ul>	(3)
(iii)	<ul style="list-style-type: none"><li>• animal biomass only indicates the total amount of biological / organic materials of all the species (1)</li><li>• it cannot reflect the impact on individual species (1)</li><li>• this can be rectified by counting the total number of species (1)</li><li>• to show the impact on biodiversity of the protected area as well (1)</li></ul>	(4)
(iv)	<ul style="list-style-type: none"><li>• Hoi Ha Wan Marine Park / Yan Chau Tong Marine Park / Sha Chau and Lung Kwu Chau Marine Park / Tung Ping Chau Marine Park / Cape D'Aguiar Marine Reserve / The Brothers Marine Park (1) (Any one)</li></ul>	(1)
(b) (i)	<ul style="list-style-type: none"><li>• Because the provision of food / nutrients from Zooxanthella has been cut off (1)</li></ul>	(1)
(ii)	<ul style="list-style-type: none"><li>• the heat / infra-red radiation reflected from the earth (1)</li><li>• is trapped by carbon dioxide in the atmosphere (1)</li><li>• hence increases the atmospheric temperature (1) and hence the water temperature increases</li></ul>	(3)
(iii) (1)	<ul style="list-style-type: none"><li>• increased water temperature resulted in a greater health deterioration in native corals than transplanted corals (1) as reflected by (<i>any two</i>)<ul style="list-style-type: none"><li>- more healthy cases in transplanted corals than in native coral (1)</li><li>- more bleached cases in native coral than in transplanted coral (1)</li><li>- more dead cases in native coral than in transplanted coral (1)</li></ul></li></ul>	(3)
(2)	<ul style="list-style-type: none"><li>• thermal tolerance of the corals can be enhanced by exposing them to higher temperatures / corals may gradually adapt to the rise in seawater temperature (1)</li></ul>	(1)

Paper 2 Section C

Marks

3. (a) (i) • simple sugars → ethanol + carbon dioxide (2)
- (ii) • during malting process, seeds absorbs water and germinates (1)  
• this activates the production of enzymes in barley grains (1)  
• the enzymes catalyse the breakdown of starch / food reserve into simple sugars (1) (4)  
• this provides the sugar source for the subsequent growth and fermentation of yeast (1)
- (iii) • this allows aerobic respiration of yeast / it provides sufficient oxygen for respiration of yeast (1)  
• to provide energy for reproduction / to increase its number / population (1) (3)  
• this facilitates the fermentation that follows / increases fermentation rate (1)
- (iv) • ethanol forms the alcoholic component / alcoholic smell of the beer (1) (2)  
• carbon dioxide forms the bubbles of the beer (1)
- (b) (i) • in both cases, the percentage of mice killed increases as the number of viral particles injected increases (1) / the more the number of viruses injected, the higher the death rate (3)  
• however, virus X killed all mice at a lower dosage than that of virus Y (1)  
• therefore, virus X is more lethal to the mice than Y (1)
- (ii) • a virus only attacks a specific cell type / a certain cell type (1)  
• if that cell type belongs to vital organs / body system, it will be more damaging to the host (1)
- OR
- some viruses have faster replication rate in the host (1) (2)  
• and lead to serious damage of the body system within a shorter time (1)
- OR
- some viruses have a latent period (1)  
• and do not cause apparent damage to the body system at early stage (1)
- (iii) • the virus attaches itself to the host cells (1)  
• and injects its genetic content into the host cells (1)  
• the virus will take over the host cell's metabolism to make copies of itself at an exponential rate (1) (4)  
• once the resources in the cells have been exhausted, the newly formed viruses will burst the host cells (1) and spread other parts to infect nearby cells

Paper 2 Section D

		<u>Marks</u>
4. (a) (i)	<ul style="list-style-type: none"><li>• The GM salmon have an additional copy of gene for producing growth hormone (1)</li><li>• therefore they should have a faster growth rate / can grow to a larger size in a short time (1)</li></ul>	(2)
(ii) (1)	<ul style="list-style-type: none"><li>• the recombinant DNA does not contain any viral materials which may cause undesirable effects / immune response on humans / which may regain the ability to cause disease (1)</li></ul>	(1)
(2)	<ul style="list-style-type: none"><li>• the insertion of the recombinant DNA into the genome of fertilized egg has high failure rate / can cause damage of the fertilized egg / time consuming as only one fertilized egg can be targeted at one time (1)</li></ul>	(1)
(iii)	Any <i>two</i> of the following: <ul style="list-style-type: none"><li>• to ensure that the transgene is inheritable over generations (1)</li><li>• and the gene can still be expressed / exert its effect after generations of inheritance (1)</li><li>• to produce salmons which are pure bred / homozygous for the transgene (1)</li></ul>	(2)
(iv) (1)	<ul style="list-style-type: none"><li>• the three sets of homologous chromosomes fail to pair up (1) during meiotic cell division for gamete formation</li><li>• so low number of viable gametes / no gametes can be formed (1)</li></ul>	(2)
(2)	<ul style="list-style-type: none"><li>• to ensure that the GM salmon cannot breed with wild salmon (1)</li><li>• to avoid passage of the transgene to others even if they escape to the wild (1)</li></ul>	(2)
(b) (i)	<ul style="list-style-type: none"><li>• use restriction enzyme R to cut both the plasmid and DNA fragment (1)</li><li>• since restriction / cut site of R can be found at both ends of the DNA fragment (1)</li><li>• as a result, two sticky ends / single-stranded DNA ends will be produced at the plasmid and on the DNA fragment (1)</li><li>• which are complementary (1) for insertion of the DNA fragments into the plasmid</li></ul>	(4)
(ii)	<ul style="list-style-type: none"><li>• it can be used to select bacteria that contain the plasmid / has been transformed (1)</li><li>• because bacteria that have successfully picked up the plasmids will possess gene for ampicillin resistance (1)</li><li>• thus they can survive on the culture plate containing ampicillin (1)</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• it can be used to eliminate bacteria that do not contain the plasmid / have not been transformed (1)</li><li>• because bacteria that have not picked up the plasmids will not possess gene for ampicillin resistance (1)</li><li>• thus they are killed on the culture plate containing ampicillin (1)</li></ul>	(3)

- (iii)
- after insertion of the DNA fragment, the tetracycline resistance gene has been interrupted / is no longer functional / cannot be expressed (1)
  - therefore, bacteria that have picked up the plasmids with successful insertion do not have tetracycline resistance (1)
  - while bacteria that have picked up self-ligated plasmid / plasmid which has not been cut / plasmid without insertion still possess tetracycline resistance (1)

(3)