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**BIOLOGY**

**9700/22**

Paper 2 AS Level Structured Questions

**March 2017**

MARK SCHEME

Maximum Mark: 60

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Marks
1(a)	label line and letter G to one of the ends of the chromosome ;	1
1(b)	anaphase / telophase ;	1
1(c)	cytokinesis ;	1
1(d)	receptor(s) ; I description of receptor	1

Question	Answer	Marks
2(a)(i)	<i>Vibrio cholerae</i> ;	1
2(a)(ii)	<p><b>A</b></p> <p>1 <i>cell structure</i>: ribosome ; <b>R</b> RER</p> <p>2 <i>difference</i>: 70S / smaller / 18 nm v 80S / larger / 25–30 nm ;</p> <p><b>B</b></p> <p>3 <i>cell structure</i>: DNA / chromosome ; <b>I</b> RNA</p> <p>4 <i>difference</i>: circular / (closed) loop v linear OR no histone proteins / naked v histone proteins OR not surrounded by nuclear envelope v surrounded by nuclear envelope ; <b>A</b> in a nucleus v not in a nucleus</p> <p><b>C</b></p> <p>5 <i>cell structure</i>: cell wall ;</p> <p>6 <i>difference</i>: murein / peptidoglycan v cellulose ; <b>I</b> lignin</p>	6

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Question	Answer	Marks
2(b)	<i>two from</i> 1 caused by, a pathogen / a bacterium / <i>V. cholerae</i> ; 2 transmissible / AW OR reference to faecal-oral route ; 3 reference to reduced effectiveness of functions / AW ;	<b>2</b>
2(c)	primary, secondary, tertiary ; <b>A</b> 1°, 2°, 3° quaternary ; <b>A</b> 4°	<b>2</b>
2(d)	<i>three from:</i> 1 cholera toxin, fits into / complementary to, receptor / GM1 ; <b>A</b> complementary shape 2 membrane pinches in / invaginates / AW ; <b>A</b> engulfs / envelops 3 membrane fusion ; 4 (endocytotic) vesicle / vacuole, formed ; 5 ATP / energy, required ; <b>A points from an annotated diagram</b>	<b>3</b>
2(e)(i)	<i>one from:</i> 1 portion that binds to cell ; 2 (antibodies produced) prevent binding to cell / prevent entry to cell ; 3 safer as not the toxic portion ; 4 A subunit, causes damage to cell / less safe / AW ; 5 AVP e.g. larger so more likely to provoke immune response / AW ;	<b>1</b>

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Question	Answer	Marks
2(e)(ii)	<p><i>five from:</i></p> <ol style="list-style-type: none"> <li>1 vaccine contains (subunit B / bacterial) antigen(s) ;</li> <li>2 primary immune response occurs ;</li> <li>3 correct ref to B-lymphocytes / formation of plasma cells ; <b>A B cells</b></li> <li>4 secretion of, antibody / immunoglobulin (against cholera antigens) / antitoxins ;</li> <li>5 T-helper lymphocytes secrete cytokine ;</li> <li>6 (cytokine) increases humoral response / stimulates T-killer cells / stimulates macrophages ;</li> <li>7 memory cell production ;</li> <li>8 secondary (immune) response / response on further infection, is faster ;</li> <li>9 higher levels of antibodies produced (during further infection) ;</li> <li>10 active artificial immunity (against cholera) ;</li> <li>11 AVP e.g. <i>idea</i> of specific antibody against each of the different vaccine antigens ;</li> </ol>	<b>5</b>

Question	Answer	Marks
3(a)	all three correct ; with the non-competitive inhibitor <b>Z</b> with the competitive inhibitor <b>Y</b> without any inhibitor <b>X</b>	<b>1</b>
3(b)	<i>four from:</i> $V_{max}$ 1 <b>X</b> and <b>Y</b> same $V_{max}$ of 10 au ; 2 $V_{max}$ of, <b>X/Y</b> , higher than <b>Z/ORA</b> ; <b>A</b> ( $V_{max}$ of), <b>X/Y</b> , 10 au v <b>Z</b> 5 au <b>A</b> ( $V_{max}$ of), <b>X/Y</b> , double the $V_{max}$ of <b>Z</b>  $K_m$ 3 <b>X</b> and <b>Z</b> same $K_m$ ; <b>A</b> $K_m$ of both is 4 mmol dm <sup>-3</sup> 4 <b>X/Z</b> , lower $K_m$ than <b>Y/ORA</b> ; <b>A</b> $K_m$ of, <b>X/Z</b> , 4 mmol dm <sup>-3</sup> v <b>Y</b> 6.5 mmol dm <sup>-3</sup> 5 reference to affinity for substrate ;	<b>4</b>
3(c)	<i>four from:</i> 1 double helix ; 2 strands are held together by hydrogen bonds (between bases) ; 3 complementary base pairing/described as A-T and C-G ; <b>A</b> purine pairs with pyrimidine R thiamine 4 antiparallel stands/strands are 3' to 5' and 5' to 3' ; <b>A</b> strands run in opposite directions 5 (each strand has a sugar phosphate backbone with) phosphodiester bonds ; 6 (monomers / units / DNA) are (DNA) nucleotides / polynucleotide strands ; 7 (nucleotide = ) <u>deoxyribose</u> sugar, phosphate, nitrogenous (organic) base ;  <b>A points from a diagram</b>	<b>4</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(d)	<i>two from:</i> 1 <i>idea that</i> , hydrogen peroxide, damage / breaks, DNA <u>and</u> repair errors (may) occur ; 2 (so leads to) incorrect, nucleotide / base, inserted (during replication) / change in, nucleotide / base, sequence (of DNA / RNA) ; 3 new allele (may be) formed ; 4 may result in an altered polypeptide / AW ;	<b>2</b>

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Question	Answer	Marks
4(a)	(closed) double circulation ; capillary ; pulmonary vein ; right atrium ; <b>A</b> auricle septum ;	<b>5</b>
4(b)(i)	<i>two from:</i> 1 <i>idea</i> that (to be transported) many substances need to, dissolve / be in solution ;  2 ionic compounds / named, can, dissociate / dissolve ;  3 polar compounds / named, e.g. glucose / amino acids, can dissolve ;  4 globular proteins / named, e.g. antibodies, can dissolve ;	<b>2</b>
4(b)(ii)	<i>three from:</i> 1 water molecules attracted to each other ; <b>A</b> sticky / stickiness  <i>cohesion:</i> 2 (hydrogen bonding provides) <u>cohesion</u> between water molecules ; <b>A</b> water is cohesive  3 reference to water leaving xylem (at top), pulling water (molecules below) ; <b>A</b> there is a transpiration pull  <i>adhesion:</i> 4 <u>adhesion</u> to <u>cellulose</u> lining (of xylem) ; <b>A</b> <u>cellulose</u> wall  5 maintains / prevents falling of, column of water ;  6 AVP e.g. reference to cellulose hydrophilic / adhesion to hydrophilic parts of lignin ;	<b>3</b>

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Question	Answer	Marks
5(a)	bronchus } ; trachea } bronchiole ; alveolus ;  <b>I</b> same structure written on more than one line	<b>3</b>
5(b)	<i>two from:</i> 1 (tobacco) smoke contains, tar / carcinogens / named carcinogen ;  2 causes mutations / mutagenic / described mutation e.g. protooncogene to oncogene / oncogene forms / tumour suppressor gene switched off ;  3 uncontrolled mitosis / AW ;	<b>2</b>
5(c)	<i>three from:</i> 1 many layers v few(er) layers ; <b>A</b> one layer / thicker  2 cells all the same v more than one type of cell / goblet cells and (epithelial) cells ; <b>A</b> no goblet cells  3 cells, flatter / smaller / cubical / AW v columnar cells ;  4 reference absence of cilia ;  5 large / prominent, nuclei / ORA ;	<b>3</b>



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Question	Answer	Marks									
6(a)(i)	surface area : volume = 1.67 : 1 ; ; <b>A</b> 1.7 : 1, 5 : 3  <i>if incorrect, allow one mark for working</i> surface area = 90 mm <sup>2</sup> <u>and</u> volume = 54 mm <sup>3</sup> <i>calculations:</i> <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 40px;">surface area</td> <td style="padding-right: 40px;">volume</td> <td>ratio</td> </tr> <tr> <td>6 × 3 × 4 (sides) = 72 mm<sup>2</sup></td> <td>6 × 3 × 3</td> <td>90 : 54</td> </tr> <tr> <td>3 × 3 × 2 (sides) = 18 mm<sup>2</sup></td> <td></td> <td></td> </tr> </table>	surface area	volume	ratio	6 × 3 × 4 (sides) = 72 mm <sup>2</sup>	6 × 3 × 3	90 : 54	3 × 3 × 2 (sides) = 18 mm <sup>2</sup>			<b>2</b>
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6 × 3 × 4 (sides) = 72 mm <sup>2</sup>	6 × 3 × 3	90 : 54									
3 × 3 × 2 (sides) = 18 mm <sup>2</sup>											
6(a)(ii)	(block <b>X</b> ) has higher, surface area to volume ratio / SA:V ; OR (block <b>X</b> ) has more surface area proportionately per unit volume / AW ;  reference to shorter distance for diffusion to centre ;	<b>2</b>									
6(a)(iii)	<i>two from:</i> 1 diffusion (rate) too slow ; <b>A</b> idea of cannot rely on diffusion  2 reference to distances too far to reach all, cells/tissues ;  3 time taken is too long / AW ;	<b>2</b>									
6(b)	Benedict's (reagent / solution) ;	<b>1</b>									