Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2017**

MARK SCHEME

Maximum Mark: 60

Published

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)	blood contained in (blood) vessels AW **or** blood contained in *any three of* heart, arteries, veins, capillaries **;** systemic and pulmonary, systems / circulation **;** **A** described *if circulations not named* e.g. for each complete circuit (round the body) blood passes through heart twice blood transported from heart to lungs and back, then to (rest of) body and back	**2**
1(b)	**2** **4** 1 **3** **5** 1st and 5th boxes (2 and 5) correct **;** 2nd and 4th boxes (4 and 3) correct **;**	**2**
1(c)(i)	*assume answer refers to arteries unless stated otherwise* withstand / AW, higher pressure (of blood) **;** prevent rupturing / bursting (from high blood pressure) **; I** collapsing *one from* thicker / AW, tunica media **;** more elastic, tissue / fibres, and (smooth) muscle tissue **;** more / AW, elastic, tissue / fibres, to maintain, blood pressure / blood flow **;** more (smooth) muscle to maintain, blood pressure / blood flow **;**	**max 2**

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Question	Answer	Marks
1(c)(ii)	*carbon monoxide max 3* forms carboxyhaemoglobin **;** **A** binds to haemoglobin less haemoglobin available to bind oxgen / haemoglobin has greater affinity for carbon monoxide / AW **;** reduces, percentage saturation of haemoglobin (with oxygen) / AW **A** less oxygen binds to haemoglobin **I** prevents oxygen binding **or** reduces oxygen carrying capacity of, haemoglobin / blood **;** *nicotine max 3* increases heart rate **;** increases blood pressure **;** constricts, arteries / arterioles **;** **A** vasoconstriction makes platelets sticky / promotes clotting / promotes thrombosis **;** *for either* damages, endothelium / tunica intima / lining of blood vessels **;**	**max 4**
	Total:	**10**

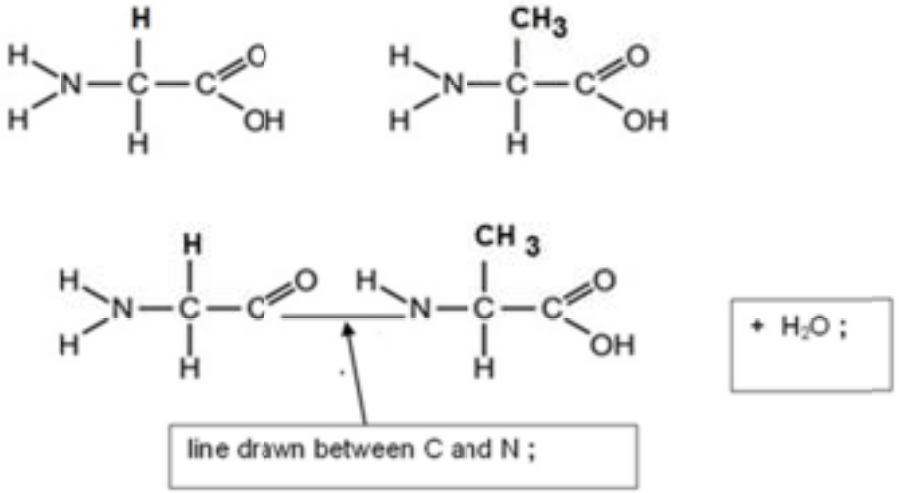
Question	Answer	Marks
2(a)	*one mark for the formula and two marks for the correct answer* (magnification =) $\frac{\text{image / scale bar (length)}}{\text{actual / object (length)}}$ **;** **A** triangle / letters only 3000 **;;** 30 000 ÷ 10 **;** *using 30 mm as measured length* **A** calculated values for measured lengths of 29 mm or 31 mm *allow one mark if correct answer given with units* *allow one mark if incorrect answer and* *correct measurement and correct working* *correct measurement and formula but incorrect conversion* *measurement ± 2 mm and correct working*	**3**
2(b)	*name* (large permanent) vacuole **;** *function* *one from* store of / holds / AW, cell sap **;** **R** if contains organelles store of / holds / AW, water / ions / named ion(s) / minerals / salts / pigments / sugars / named sugars **;** **A** nutrients **I** substances / molecules / food **I** storage unqualified pushes chloroplast to edge of cell **;** gives, turgidity / turgor pressure / hydrostatic pressure / support / AW **;** **A** makes, firm / rigid **A** controls / maintains, turgidity **I** gives shape / strengthen / provides structure store of / holds, waste (products) **;** **A** breakdown of (large) waste products **I** reactions occur in vacuole, unqualified *allow function mark even if name of organelle left blank or incorrect*	**2**
2(c)	nucleus **;** chloroplast(s) **;** mitochondrion **;** **A** mitochondria	**max 2**

Question	Answer	Marks
2(d)	***A*** nucleic acid / DNA / RNA **;** **A** genetic material **I** strand **R** circular DNA ***B*** protein coat / capsid / capsomere / protein subunit **;**	**2**
2(e)(i)	gene coding for systemin is (a length of) DNA **;** **A** *idea that* a length of DNA codes for systemin transcription / production of mRNA **;**	**2**
2(e)(ii)	herbivore proteases and plant proteases have different (shaped) active sites **;** serpin / competitive inhibitor, only complementary to (shape of) active site of herbivore proteases **; ora** **A** can only fit serpin is specific to (active sites of) herbivore proteases **;** AW proteases act on different, substrates / (parts of) proteins **;** **A** similar shape only to herbivore substrates AVP **;** e.g herbivore proteases cut at different amino acid sequences *allow other acceptable suggestions e.g.* *suggestion that* serpin physically separated from plant proteases **;** detail, e.g. in vesicle / plant proteases in vacuole **;** cannot bind to active site of plant proteases **;** serpin released when plant parts ingested by herbivores **;**	**max 3**
2(e)(iii)	affinity for substrate has decreased **;** needs a higher concentration of substrate to saturate active sites / AW **;** **A** needs a higher concentration to reach, ½ Vmax / Vmax *idea that* inhibitor prevents substrate from binding (to active site) so more substrate required (to compete) **;**	**1**
	Total:	**15**

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Question	Answer	Marks
3(a)	*Mycobacterium tuberculosis* **/** *Mycobacterium bovis* **;** *correct spelling*	**1**
3(b)	**1** deaths decrease to zero **/** new cases fall to 4 per 100 000, (in 2010) **;** **A** other values that confirm decrease *(after introduction of antibiotics*) **2** deaths relatively constant / approx. 52 per 100 000, until 1943–6 (*accept any in range*) **; A** for a few years **A** *idea that* rate of decrease not improved **3** number of new cases initially stops increasing / plateaus **;** **4** (overall) number of new cases increases before decreases **;** **5** data to support mp 3 or 4 **;** e.g. 88–90 per 100 000 (1940–44) rises to / drops from, 104 per 100 000 in 1946 **;** *(after introduction of vaccination)* **6** no change in trend of decrease in deaths / deaths continue to decrease **;** **7** decrease from 36–40 per 100 000 (in 1948) **;** **8** short plateau / 100 per 100 000 (until 1950), in new cases, then decreases **;** **9** antibiotics may not have been in widespread use at first **; ora** **10** vaccine, reduces spread / gives (herd) immunity **;** **11** *ref. to* decrease less steep initially as time needed to build up herd immunity **;** **12** AVP **;** e.g. suggestion why increase in new cases after introduction of antibiotics suggestion why cases have not decreased to zero not possible to tell relative effect of vaccine v antibiotic	**max 5**

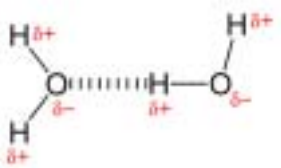
Question	Answer	Marks
3(c)(i)	some people who are HIV+ will have developed HIV / AIDS **;** HIV / AIDS weakens immune, system / response **; ora** *allow **ecf** for HIV+ people* detail of why immune response weakened **;** people with HIV / AIDS, prone to opportunistic diseases **;** **A** TB is an opportunistic disease **A** more susceptible to, diseases / TB (Table 3.1 shows that) a greater proportion / AW, people die of TB if they are HIV+ **;** AW e.g. greater chance of dying from TB if HIV+ dormant TB more likely to become the active form in, HIV+ people / people with HIV / AIDS **;** AW AVP **;** a high proportion of deaths from HIV / AIDs is due to TB mortality HIV+ people do not respond well to treatment for life-threatening diseases inability to pay for treatment for all conditions for HIV+ people	**max 3**
	Total:	**9**

Question	Answer	Marks
4(a)	✓ ✗ ✗ ✓ ✓ ✓ ✗ ✓ ✗ ✗ ✓ ✗ ✗ ✓ ✗ ✓ one mark per column **;;;;**	**4**
4(b)	*allow diagrams with glycine on right*  bond forms between the C of the carboxyl group and the N of the amino group **;** **A** amine *for amino* water / H_2O, is formed **;** **A** condensation (reaction) **R** hydrolysis amino acid residues correctly drawn **;**	**3**

Question	Answer	Marks
4(c)	receptor(s) / cell signalling **;** cell recognition / antigens **;** cell adhesion **;** form H-bonds with water to stabilise membrane **;** enzyme **;** AVP **;** e.g. *ref. to* role in antigen presentation / MHC	**max 2**
	Total:	**9**

Question	Answer	Marks
5(a)	**1** DNA (double helix) unwinds **; A** uncoils **I** unzips **R** DNA strand unwinds **2** hydrogen bonds break between, base pairs / bases / strands **;** **3** both strands used as templates **;** **4** catalysed by / AW, DNA polymerase **;** **5** *ref. to* (free) activated nucleotides / AW **;** **6** complementary (DNA) nucleotides added **; R** RNA nucleotides **A** described in terms of complementary base pairing **7** step-by-step / sequentially / AW **;** **8** *idea that* process continues, along whole DNA molecule **;** **9** replication bubbles / described **or** *ref. to* Okazaki fragments **;** **10** replication is semi-conservative / each newly formed molecule contains one original and one newly synthesised strand **11** AVP **;** e.g. *ref. to* repair / proofreading *ref. to*, helicase / ligase *in correct context*	**max 5**
5(b)	telomere(s) **;**	**1**
5(c)(i)	adenine <u>and</u> guanine **;**	**1**
5(c)(ii)	*idea that* purines and pyrimidines are different sizes / two rings and one ring **;** purine normally bonds with pyrimidine (to maintain DNA double strand width) **;** *idea that* two purines or two pyrimidines will distort the double helix width (in a transversion event) **; ora** AVP **;** e.g. (transversion event) more likely to be detected by the repair mechanism **ora**	**max 2**
5(d)	*idea that* mutation occurs for a gene controlling cell division **;** detail **;** e.g. proto-oncogene to oncogene tumour suppressor gene switched off **;** *ref. to* disruption of cell cycle / shortened interphase **;** (results in) uncontrolled cell division **; I** uncontrolled growth other detail of result of mutation **;** e.g. divide indefinitely / no programmed cell death do not respond to signals to stop dividing loss of, specialisation / function	**max 3**
	Total:	**12**

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Question	Answer	Marks
6(a)	two water molecules drawn with correct bonding **;** **I** Fischer projections partial charges shown as σ+ on at least one H and σ– on at least one O **;** hydrogen bond shown **;** e.g. labelled or as dashed or dotted lines between H of one molecule and O of another **;** 	**3**
6(b)(i)	cohesion **;**	**1**
6(b)(ii)	high / large, latent heat of, vapourisation / evaporation **;** **A** takes a large amount of, heat / energy, to evaporate / turn liquid to water vapour	**1**
	Total:	**5**