Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

**BIOLOGY** **9700/22**

Paper 2 AS Level Structured Questions **May/June 2016**

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) |
| **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 |
| **AVP** | alternative valid point |

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**1 (a) A** activation energy / energy of activation **;**

**B** induced fit **;** **A** induced fit, model / hypothesis / theory / mechanism

**C** globular **;**

**D** extracellular **;**

**E** Michaelis-Menten constant **;** **A** $K_m$ **[5]**

**[Total: 5]**

**2 (a) (i)** curled / rolled, leaf **;** **R** curly / curved / folded
**or**
trichomes / hairs **;** **A** hair / hairy,-like structures **R** cilia / spines / needles **[1]**

**(ii)** *allow explanations for stomata in pits, thick cuticle and no stomata on outer surface as ecf from (i)*

*curled leaf / trichomes / stomata in pits*
*ref. to* (creates) still / non-moving, air **;**
(in enclosed area) humid / moist **;** AW, e.g. traps water vapour / maintains humidity

water potential gradient less steep **or** decreased rate of diffusion of water vapour (out) **;**
**A** (water) vapour pressure gradient for water potential gradient
**I** decreased concentration gradient of water vapour
*assume in context of between substomatal air space and enclosed area unless stated otherwise*

*thick cuticle*
greater layer impermeable wax / AW **;** **A** thicker waterproof layer
increases distance for diffusion **;**
of water vapour **;**

*no stomata on outer surface*
most water lost via (open) stomata **;**
cuticular transpiration only **;**
*ref. to* where most exposure to, light / air currents / wind **;** **[max 2]**

**(b)** xerophytic **/** xerophyte **;** **[1]**

**[Total: 4]**

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**3 (a) (i)** 1179 **;;**

*one mark* *if not to the whole person e.g. 1179.24 / 1179.2* **or**
*if calculation correct but answer incorrect*
e.g. 1.39 × 848.38 **or** 1.39 × (84 838 000/100 000) **or**
*if no calculation to check but answer given as 1180* **[2]**

**(ii)** **1** provides information about / AW, proportion / percentage, (of population) affected / AW **;**

**2** to, make (valid) comparisons / compare **;** *between countries / in one country over time*

**3** provides information about severity of disease **;** AW

**4** population size, taken into account / different for different countries / changes over time in a country **;**
*do not need 'size' if 'use of 'population' is in correct context*

**5** *idea that* countries with larger populations will usually have more cases / higher number of cases may just mean larger population of country**;**

**6** AVP **;** gives guidance about whether the disease is, spreading / becoming an epidemic / dying out (in one country) *in context of over time*
*idea that* number of cases per 100 000 are, standardised / normalised, values

**7** use of data to support **;** *only two of Chad, Eritrea or Ethiopia where comparisons between countries stated* **I** *ref. to* other countries

(2009) actual cases and standardised cases

comparison (2009) to support mp 5 population size and actual cases

stated values of similar number of cases per 100 000 and populations of different sizes

countries compared, number of cases per 100 000 for any stated year, with comment about severity

number of cases per 100 000 for one country over time, with comment about severity / spreading / dying out / control / AW **[max 3]**

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**(b)** *can give values of percentage vaccinated to describe 'increasing / decreasing' percentage vaccination*

*support*

**1** Gambia high percentage vaccinated (throughout) and low number of cases **;**
**A** Eritrea

**2** data to support **;** *e.g. a percentage vaccination for a year <u>and</u> number of cases (same, or following, year after vaccination) or a range given for percentage vaccinations over the whole, or stated, number of years or a compilation of the two*

*partial / weak, support*

**3** Central African Republic decreasing vaccination and number of cases in 2011, higher / 15.31 **;**

**4** Chad (from 2008) increasing percentage vaccination and, low / stated, number of cases,
2009 / 2010 / 2012 **;**
1.45 1.66 0.96

*do not support*

**5** Niger / Ethiopia / Chad, (generally) increasing percentage vaccinated and number of cases, fluctuates / increase and decrease (ora) / AW **;**
**A** stated correct data *to show increase and decrease*
**A** for Chad if mp 4 given and ref. to increase / 71.6 in 2011

**6** (generally) increasing percentage vaccinated and number of cases, increases / goes from 2.34–4.67, in 2011 in Niger **or**
increases / goes from 1.39–4.86, in 2010 in Ethiopia **or**
increases / goes from 1.66–71.6, in 2011 in Chad **A** 1.45–1.66 in 2010 **;**

**7** Central African Republic decreasing vaccination and low number of cases in, 2009 / 2010 / 2012 **;**

**8 / 9** AVP **;;** e.g.

- *idea that* most values for number of cases are low irrespective of vaccination percentage
- *ref.to* needs, high / 90%, vaccination to be effective
  **A** < 80% / low, vaccination ineffective
- *idea that* generally Gambia / Eritrea, have higher percentage vaccinated and have lower number of cases than, (three of) Ethiopia, Chad, Central African Republic, Niger / the other countries
- *ref. to* Chad / Central African Republic, in 2011 and, epidemics / inability to keep number of cases down / ineffectiveness of vaccination programme **I** *ref. to* 71.6 (Chad) or 15.31 (Central African Republic)
- Eritrea 2012 high vaccination but, increase in / 3.16, cases
- *ref. to* increasing percentage of vaccination in Niger and decrease in cases, 2009–2010 from 5.23 to 2.34 / 2011–2012 from 4.67–1.59
  **A** 2009–2012 from 5.23 to1.59 **[max 4]**

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**(c)** *points refer to smallpox, look for points written as ora*
*any two from*

**1** high, percentage / proportion, immunised / vaccinated **;** AW
**A** mass vaccination

**2** no boosters required / one dose enough / immunity very long-lived **;**
**A** *idea of* long-lasting effect of vaccine

**3** same, vaccine / antigens, used (throughout) **;**
*treat as neutral ref. to, low mutation rate / stability, of smallpox virus*

**4** heat stable / thermostable / freeze-dried / lyophilised, vaccine **; I** frozen
**A** no need to refrigerate / AW
**A** *idea of* longer shelf-life

**5** ease of, administering vaccine / training people to give vaccine **;**

**6** ring vaccination / described, e.g. contact tracing **;**

**7** easy to identify infected people / AW, (to begin ring vaccination) **;**

**8** lower percentage cover required for smallpox than measles / lower herd immunity required **;**

**9** AVP **;** smallpox less infectious (so lower percentage cover required)
*idea of* less, civil unrest / war / movement of populations (so easier to implement)
suggestion that smallpox live vaccine (and measles not live) **[max 2]**

**(d)** active artificial / artificial active **;** *treat as neutral* acquired **[1]**

**(e)** *can be from point of view of country programme or WHO programme cost*

**1** preparing / manufacturing / purchasing, vaccine **; A** cost to provide vaccine free to developing countries

**2** disposables / equipment to administer (vaccine) **;**
e.g. syringes / needles / (protective) gloves

**3** storage **;** e.g. space, security

**4** refrigeration / maintaining cold chain **;**

**5** transport (of, vaccine / health care workers) **;**

**6** wages / training, of staff involved **;** e.g. wages for, health care workers administering vaccine / staff involved in training health care workers

**7** record keeping / contact tracing **;**

**8** advertising / informing / marketing / education **;**

**9** research / development **;**

**10** setting up vaccination / immunisation, camps (for remote / epidemic, areas) **;**
**I** building, hospitals / clinics **[max 2]**

**[Total: 14]**

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**4** **(a)** blood contained in (blood) vessels AW
**or**
blood contained in *any three of*
heart, arteries, veins, capillaries **;**

systemic and pulmonary, systems / circulation **; A** 'systematic'
**A** described *if circulations not named*
e.g. for each complete circuit (round the body) passes through heart twice
from heart to lungs and back, then to (rest of) body and back **[2]**

**(b)** **W** = aorta / aortic arch **;**
**X** = pulmonary vein **;**
**Y** = right atrioventricular / tricuspid, (valve) **;**
**Z** = left, atrium / auricle **;** **[4]**

**(c)** red blood cells **;** **A** rbc
**A** platelets
**A** plasma proteins / named **[1]**

**(d)** **1** *idea of* carbon dioxide out (of blood to alveolus) and oxygen in (to alveolus from blood) **;**

**2** diffusion / diffuses
**or**
(movement from) high concentration to low concentration / down a concentration gradient **; A** diffusion / pressure, gradient

**3** (across) squamous epithelium / squamous cells (of alveolar wall) **;**
**A** pavement cells

**4** (and) endothelium / endothelial cells (of capillary wall) **;**
**A** squamous cells *but must be clear that this is for capillary wall*

**5** oxygen, into / AW, red blood cells **; I** oxygen binds to Hb

**6** steep gradient maintained by, ventilation / uptake by haemoglobin / blood carries oxygen away / blood arrives with carbon dioxide / deoxygenated blood arriving low in oxygen **[max 4]**

**(e)** **(i)** **F** = nucleolus **; A** nucleus
**G** = cell surface / plasma, membrane **;** **[2]**

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**(ii)** transport / transporter / carrier, protein **;** **R** pump protein

specific protein **;**
glucose, binding site / AW **;** **I** glucose binds **R** glucose receptor
*specific binding site (in protein) = 2 marks*

(glucose binding causes) conformational change **;** AW, e.g. changes shape

passive / no energy required / no ATP required **;**

movement is, down the concentration gradient / from high to low concentration **;** *must be in context of through the membrane protein* **[max 3]**

**[Total: 16]**

**5** **(a)** **(i)** coiling / supercoiling / condenses / condensation **;**
**A** become shorter and thicker **R** contracts **[1]**

**(ii)** *accept from labelled diagram*
two chromatids **;**
identical / sister, chromatids **;**
joined by a centromere **;** **A** kinetochore

*one from*
(reach chromatid) DNA complexed with protein
histone proteins / histones
telomeres at end of chromatids
} **;** **[max 3]**

**(b)** *metaphase versus anaphase*
*idea of* single chromosome of two chromatids versus two separated chromatids / daughter chromosomes
e.g. two chromatids versus, one chromatid / one daughter chromosome **;**
sister chromatids joined at centromere versus chromatids separated
distance between sister chromatids zero versus increasing distance between chromatids
share a centromere versus do not share a centromere / centromere divides

two DNA molecules versus one DNA molecule **;**

at, equator / metaphase plate versus towards / at, poles **;** **R** centre **R** ends

linear / straight versus V shape / AW **;** **[max 2]**

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**(c)** acts at <u>target</u> cell **;**

binds to receptor **;** **R** receptor cells *allow ecf for other mps*
**R** trapped / caught

ref. specificity **;** **A** receptor complementary (shape) for cytokinin
**A** cytokinin fits into receptor *this is also mp2*
**A** recognition of cytokinin by receptor

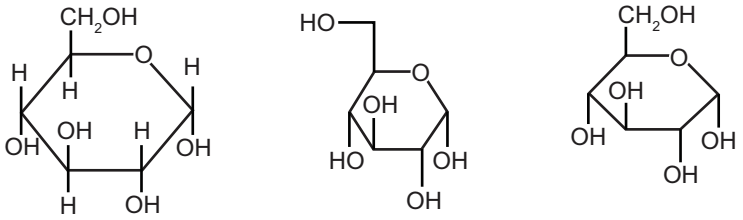
receptor (located) in, cell surface / plasma, membrane **;**
**A** cell membrane **A** phospholipid bilayer **A** transmembrane receptor

sets off / AW, response in the cell / described response(s) **;** e.g.
triggers secondary messenger
activates enzyme(s)
**I** signals / causes / stimulates, cell to divide / cytokinesis

(acts) <u>extracellularly</u> / <u>extracellular signal</u> **or** (acts) <u>intracellularly</u> / <u>intracellular signal</u> **;** *must be in context of candidate's answer* **[max 3]**

**[Total: 9]**

**6 (a) (i)**




1 2 3

two marks for correct drawing of ring structure **;;**
*all atoms shown **or** one of diagrams 1–3 above*

*one mark if, inconsistent / incomplete, drawing:*
*diagram 1 – <u>one</u> missing H from any of carbons 2–6 (OH groups and rest of drawing must be correct)*
*diagrams 2 and 3 – adding the H to <u>one</u> of carbons 1–5 (OH groups and rest of drawing must be correct)* **[2]**

**(ii)** glycosidic **;** **A** glucosidic **[1]**

**(iii)** to form / has, (glycosidic $\alpha$) 1–6, bonds / links (to make branches) **;**

*ref. to* different shaped / specific / complementary, active site required to form bonds (for branching) **;** **[max 1]**

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**(b) (i)** *treat as neutral unit of inheritance*
sequence of, nucleotides / bases **;**
section / length / part, of DNA (molecule) **;**
codes for a polypeptide **; A** protein *for polypeptide* **A** enzyme
**A** information to produce a polypeptide
**A** codes / information, for sequence of amino acids / primary structure (of a, polypeptide / protein)
**R** genetic code for a polypeptide **[max 2]**

**(ii)** **1** (in DNA / gene) altered, sequence / AW, of, nucleotides / bases **;**
**I** DNA sequence
**2** base substitution
**or** base / nucleotide, replaces another, base / nucleotide**;**
**A** example *must be in context of, DNA / gene*
**3** (mRNA synthesised) during <u>transcription</u> **;**
**4** (mutation leads to) altered / AW, <u>mRNA</u> / <u>messenger RNA</u> **;**

**5** (only) one (mRNA) <u>codon</u> changed / a different <u>codon</u> **;**
**A** one DNA, triplet / codon, changed **I** *ref. to* codon<u>s</u> changed

**6** tRNA, with / has, a different anticodon **;**
**7** (tRNA) brings, a different / a changed / the incorrect, amino acid, during <u>translation</u> / to the ribosome **;**
**8** codon-anticodon, binding / complementary / AW **; A** matches
**R** amino acid with anticodon **[max 3]**

**(c)** nucleolus **;** **R** if other cell structures given
mitochondrion **;** **R** if other cell structures given

rough endoplasmic reticulum **or** Golgi (body / apparatus / complex) **;** **[3]**

**[Total: 12]**

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