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CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9700 BIOLOGY

9700/21 Paper 2 (AS Structured Questions), maximum raw mark 60

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;	separates marking points
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AW	alternative wording (where responses vary more than usual)
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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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1 (a) *one mark per row*
penalise once for stated ecf and then mark to max 4 [6]

	name of organelle	function
A	*cell surface membrane*	*control of movement of substances into and out of the cell*
B	nucleolus	production of, ribosomes / rRNA / tRNA ;
C	mitochondrion **A** mitochondria	one from ; aerobic respiration ATP synthesis/ production / AW link reaction Krebs cycle oxidative phosphorylation **R** produces energy / ATP energy
D	smooth endoplasmic reticulum **R** SER or smooth ER	lipid / sterol / cholesterol / steroid, synthesis ; *ecf if SER, or Golgi is named organelle*
E	rough endoplasmic reticulum **R** RER or rough ER	one from ; protein / polypeptide, synthesis translation modification of protein / described (e.g. folding, glycosylation) protein transport (to Golgi) *ecf if RER*
F	Golgi (body / complex /apparatus)	one from ; modification of protein glycosylation / described modification of lipid pack(ag)ing (of), protein / lipids production of, (Golgi / secretory) vesicles / lysosomes ***ignore*** synthesis of protein *allow ecf if smooth endoplasmic reticulum*
G	lysosome *or* Golgi / secretory, vesicle	contains /storage of, hydrolytic / digestive, enzymes *or if Golgi vesicle* transfer / transport, of, protein / lipids ;

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(b) *max 3 if only structure or only explanations given*

polysaccharide ;

chains of α-glucose (residues) ; *only need α once*
α1–4 glycosidic bonds / links ;

branches ;
(because of) α 1–6 glycosidic bonds ; *only need glycosidic once*

idea that many 'ends' to easily, add / remove, glucose ;
compact / AW ;
insoluble ;
will not affect, water potential / ψ ; AW
AVP ; [max 4]

[Total: 10]

2 (a) (i) 1 diffusion through (freely permeable) cell wall;
2 membrane is partially permeable ; **A** selectively
3 osmosis across membrane (into cell)
4 (only) some water may pass between phospholipids (across membrane);
5 movement across membrane facilitated by aquaporins ;

6 ref. down water potential gradient / from high water potential to low water potential; **A** from a higher / to a lower, water potential *if in context*
7 AVP ; e.g. further detail about aquaporin (hydrophilic channel) [max 3]

(ii) 1 increases permeability of membrane to water ;
2 *idea that* osmosis across bilayer does not supply cell rapidly enough with water (that needs to pass on to surrounding cells) ;
3 *idea that* phospholipids are relatively impermeable to water ;
4 *idea that* water cannot pass / only some water passes, through <u>hydrophobic</u> region of membrane / AW ; [max 1]

(b) pathway via, cells of cortex / cortical cells, and endodermis / endodermal cells ;

symplast pathway, described as
cytoplasm <u>and</u>, plasmodesmata / vacuole(s) ;

(out of cell to) apoplast pathway, described as
cell wall pathway ;

Casparian strip / suberised cell wall, of endodermis, impermeable to water ;
(so) pathway only via, symplast / cytoplasm ;

AVP ; e.g. reference to pericycle
reference to passage cells of endodermis
vacuolar pathway *(unless given in mp 2)* [max 3]

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(c) **(i)** stomata are open (to absorb carbon dioxide for photosynthesis) ; ora [1]

(ii) rate of transpiration, (almost) always / AW, higher / higher at night, in A / mutant plants ; ora
A *expressed in terms of water loss*
at night only cuticular transpiration / no stomatal transpiration ;
idea that during day stomatal transpiration same for both ;
(so) differences because of less effective cuticle ;
comparative data quote ; [max 3]

[Total: 11]

3 **(a)** **(i)** **K** – (DNA) replication / synthesis / described ;
L – cytokinesis / cytoplasmic division / cell division ; [2]

(ii) 3 ; [1]

(iii) remain the same / stays constant / stay at 46 / AW ; *ignore description of events occurring before and during mitosis* [1]

(b) transcription (of specific genes) ; **A** reference to gene switching
protein / polypeptide, synthesis ; **A** translation
production of haemoglobin ;
further detail ; e.g. assembly of quaternary structure
(production of) carbonic anhydrase ;
loss of, mitochondria / named organelles ;
loss of nucleus ;
adopts biconcave disc shape ; [max 3]

(c) occurs in both primary and secondary (immune) responses ;
selected / specific / AW ;
lymphocytes / B -cells / T-cells / divide (by mitosis) ;
clonal expansion / described in terms of producing, clone / many cells ;
A *idea that* different types of immune cell can result
reference mitosis in memory cells (for rapid) secondary response ; [max 3]

(d) *T helper / Th,*
secrete, cytokines / interleukins ;
activate B-lymphocytes to, divide / form plasma cells ; **A** idea that leads to enhanced antibody levels
enhances / AW, phagocyte / macrophage, response ; **A** angry macrophages ;

T cytotoxic / Tc / T killer / Tk
attach to / kill / AW, infected cells / damaged cells / tumour cells / cells with non-self antigens / AW;
mechanism of killing ; e.g. perforin

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T memory / Tm
already exposed to antigen ;
reference to role in secondary response ;

AVP ; ; e.g. T suppressor cells
function of suppressor cells [max 3]

[Total: 13]

4 (a) *ignore reference to, first / third / fourth, trophic level*

(primary) producer ;
secondary consumer ; **A** second / 2°, consumer
tertiary consumer ; **A** third / 3°, consumer [3]

(b) 1 polar bear is, tertiary / quaternary consumer / top carnivore ; **A** in fourth / fifth, trophic level
2 feeds (only) on ringed seals ;
3 therefore limited, food / energy, supply ;
4 reference to ringed seals competing for food / food for seals shared with, others / named ;
5 reference to energy loss, within / between, trophic levels ; **A** approx 90% loss from one trophic level to the next
6 any two examples of, energy / heat, loss in lower trophic levels ; e.g. heat loss from, respiration / movement / digestion / excretion / egestion / indigestible parts / to decomposers / death but not eaten [max 4]

(c) *decrease in population of Arctic cod so higher trophic levels*
1 less, food / energy, (for consumers of cod / higher consumers) ;
2 more competition for food ;
3 consumers / named consumers, of cod feed on other levels ;
4 starvation / decrease in population / extinction(s) (of other species) ;
5 migration to areas where food is more plentiful ;

lower trophic levels
6 increase in numbers of
either, copepods / AW *or*
arrow worms / AW ;
7 (so) decrease in population of phytoplankton ; *only if mp 4 not scored*
8 (so) increased competition with bivalve molluscs ; *only if mp 2 not scored* [max 3]

[Total: 10]

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5 **(a)** *closed* blood travels, inside blood vessels / AW ;
double blood travels through the heart twice during one, complete circuit / circulation of the body ; AW
A pulmonary and systemic, systems / circuits [2]

(b) **P** to right atrium ;
Q to (semilunar) pulmonary or aortic valve ;
R to, vena cava / pulmonary artery ;
S to, septum / wall(s) of ventricles ; [4]

(c) **(i)** 75 (beats per minute) ;;

if incorrect answer or no answer allow one mark for extraction from Fig. 5.2 or for correct working
e.g.10 beats in 8 seconds
10/8 × 60 [2]

(ii) *max 3 if only description or only explanation given*
lowest pressure in aorta, is 10.8 kPa / varies between 10.8-11.2 kPa v in left ventricle is 0 KPa ;
difference between highest and lowest is greater in the ventricle / AW ;
4.8 – 5.2 kPa for aorta, 16.0 kPa in left ventricle ;

reference pressure differences (in left ventricle) as a direct result of ventricular systole and diastole ;
semilunar / aortic, valve prevents backflow from aorta into ventricle ;
(so) no / little, blood in ventricle, when fully contracted / AW ;
elastic recoil of artery maintains (diastolic) blood pressure ;
AVP ; [max 4]

(d) **(i)** coronary arteries ; [1]

(ii) insufficient, glucose / oxygen (to, cardiac / heart, muscle) ;
angina ;
heart attack / myocardial infarction / cardiac arrest ;
description of anaerobic conditions in muscle ; [max 1]

(e) coronary (artery) by-pass (graft) operation ;
R by-pass *unless qualified*
A described
insertion of a (coronary) stent ; **A** described
heart transplant ;
angioplasty ; **A** described
AVP ; e.g. calcium-channel blockers / named
further detail of treatments e.g. anticoagulants after angioplasty [max 2]

[Total: 16]

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1 (a) *electron microscope*
accept ora for light microscope

1 higher resolution / better resolving power;
A high *only if further detail confirms understanding*

2 more easily able to distinguish between two (separate) points / AW;
A *if no comparative but mp 1 or relevant point in mp 3 gained*

3 **AVP**; able to see points closer together than 200 nm **A** range 100 – 300 nm
can see points up to 0.5 nm (0.0005 μm) apart but LM is 200 nm (0.2 μm) **A** range 0.2 – 1.0 nm
electrons have shorter wavelength (than light)
wavelength of electrons shorter than size of additional structures seen [max 2]

(b) *each feature must be briefly qualified to gain max 3*
penalise once if feature correct but not correctly qualified / or not qualified

1 detail of mitochondria; e.g. inner membrane / crista(e)
double membrane
ribosomes
(circular) DNA

2 detail of chloroplasts; e.g. double membrane
internal membranes
thylakoid(s) / grana / intergrana / lamellae
ribosomes

3 ribosomes, qualified; e.g. visible as small dots
scattered throughout / in cytoplasm
on RER

4 smooth endoplasmic reticulum / SER, qualified; e.g. no ribosomes / tubular / membranous

5 rough endoplasmic reticulum / RER, qualified; e.g. ribosomes / membranous / flattened cisternae;

4/5 endoplasmic reticulum / ER, qualified; e.g. smooth and rough / membranous / throughout cytoplasm

6 Golgi vesicles / secretory vesicles / lysosomes qualified;
e.g. forming from Golgi
ref. exocytosis (not for lysosomes)
seen as (small) sacs / AW
membranous

7 heterochromatin darker staining / euchromatin lighter staining;
A chromosomes seen as heterochromatin and euchromatin

8 nucleus has, nuclear envelope / two membranes;

9 nuclear pores in nuclear envelope;

10 cell surface membrane, qualified; e.g. to the inside of the cell wall

11 *idea that* (cell) membranes are visible, qualified; e.g. thin / round / within organelles /

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named organelle [max 3]

(c) *award two marks if correct answer is given, only one mark if μm (units) given*

× 1600;;
A in range of × 1400 to × 1800

(8 000 / 5 μm)
7 000 / 5 μm = (1400)
9 000 / 5 = (1800)

award one mark if correctly measured and divided by 5 μm but incorrectly converted
award one mark if incorrect measurement (e.g. whole cell) but correct formula used (i.e. divided by 5 μm) [2]

(d) (i) 1 amylopectin branched / AW; **ora**
2 amylose, spiral /spiralled / helix / helical; **ora**
R α – helix
R coiled
allow ecf from mps 1 and 2 to award mp 3
3 amylose (α) 1 – 4 linkages but 1 – 4 and 1 – 6 linkages in amylopectin / amylose has 1 – 4 linkages only;
accept from clearly labelled diagram(s) [max 2]

(ii) *any one valid; e.g.*
1 for chlorophyll, structure / synthesis / formation / AW
2 for ATP functioning **A** required for energy transfers
3 for enzyme, functioning / cofactor
4 signalling ion / regulates carbon fixation
5 for, DNA / RNA, synthesis
6 stabilises, DNA / RNA, structure
7 required in, translation / joining, small and large subunits (of ribosomes) [1]

[Total: 10]

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2 (a) (i) 1 obvious bilayer (of phospholipids) shown, phospholipid with single head and two tails;
must have inner / outer membrane label(s) to gain mp 2 and 3
allow 1 mark if both glycoprotein and glycolipid on one side and no inner / outer label

2 glycoprotein labelled; } **A** glycocalyx *for one mark, must have inner / outer label*
3 glycolipid labelled; }

4 one type of protein drawn and labelled as protein;
treat description as neutral

5 protein type qualified; e.g. if protein is labelled as

integral / intrinsic	*must extend into hydrophobic core and be in phosphate head portion*
transmembrane / transport / carrier / channel / pore	*must extend across / through bilayer if channel protein must show channel*
peripheral / extrinsic	*must be on surface / on one side*
aquaporin	
gated protein	

6 cholesterol, labelled; *must extend into hydrophobic core*
if, circular / globular, must be smaller diameter than phospholipid head or have a single tail
R *if indistinguishable from a protein drawn on diagram*

7 detail of phospholipid, labelled; e.g. phosphate / hydrophilic head
fatty acid / hydrocarbon / hydrophobic tail
saturated / unsaturated fatty acid tails

8 hydrophobic core, labelled;
look for label to include both layers

9 **AVP**; e.g. cytoskeletal filaments [max 5]

(ii) *fluid*
1 molecules (of membrane) move about / AW; **A** *idea of membrane flowing*
2 further detail; ref. to phospholipid and protein molecules moving or ref. to (lateral) diffusion
phospholipid and protein molecules move about = 2 marks

mosaic
3 protein molecules, interspersed / scattered / not a complete layer / AW;
4 many / AW, different / AW (protein molecules); [max 3]

[Total: 8]

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3 (a) (i) all arrow heads in correct direction (phytoplankton to herring / krill, krill to herring, herring and krill to whale); [1]

(ii) secondary / tertiary, consumer;
A third / fourth (trophic level) [1]

(iii) 1 plenty of food available / AW;
A feeding on more than one trophic level
2 further detail; e.g. phytoplankton efficient at converting light energy
phytoplankton blooms
little / no competition
ref. efficient feeding mechanism
3 short food chains / fewer links of the food chain;
4 less energy lost overall;
A *idea in terms of* percent lost at each level
5 few, indigestible / inedible parts; [max 3]

(b) 1 fat / blubber = triglyceride;
2 fat / blubber / triglyceride, used as <u>energy</u>, store / reserve;

decreases
3 less fat in cells; ora
A fewer fat-filled cells / less adipose tissue
4 mobilised / respired / converted to fatty acids (**A** glucose), to release energy (during non-feeding season);
5 energy (from fat mobilisation) used, qualified; e.g. for movement

increases
6 food eaten / during feeding season, <u>conversion</u> to, fat / AW (for storage);
7 ref. thermal insulation;
A *idea of* prevents heat loss **R** keeps it warm [max 2]

(c) 1 (good) solvent / AW; e.g. (many) ions / minerals dissolve (in water)
A idea of (sufficient) dissolved respiratory gases (to support life)
2 provides, buoyancy / support / AW;
A *idea of floating*
3 (buoyancy / support) enables some to attain a large size / supports large mass / enables phytoplankton to remain, near / at surface;
4 high specific heat (capacity);
5 qualified; aquatic environment, more temperature stable / slow to change temperature / helps whale to maintain constant body temperature
6 ice, floats / less dense than water;
7 acts as insulator / prevents heat loss from water / water is underneath allowing survival in the winter;
8 transparent, for light penetration / for photosynthesis / for visual cues;
9 (density changes causing convection) currents, maintain circulation of nutrients / make nutrients available to support phytoplankton;
10 **AVP**; e.g. ref. to surface tension prevents sinking (small organisms) ref. to gamete movement [max 3]

[Total: 10]

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4 (a)

name of disease	type of causative organism	name of causative organism
cholera	bacterium / bacteria	*Vibrio cholerae*
HIV / AIDS	virus	human immunodeficiency virus;
malaria	protoctist; **A** protozoa / protista **A** apicomplexa / sporozoa	*Plasmodium, vivax / ovale / falciparum / malariae;* **A** *Plasmodium (spp)*
tuberculosis (TB)	bacterium / bacteria;	*Mycobacterium tuberculosis*

[4]

(b) (i) cholera; [1]

(ii) antibiotics / antibacterials / antimicrobial and one reason;
e.g. kill / inhibit, bacteria
bacterial infection / caused by bacterium
do not kill humans
A harmless to human / AW [1]

(iii) 1 vaccinated children, are immune / AW;
ignore resistant
2 herd effect;
3 explained; e.g. sufficient / AW, vaccinated / immune, to prevent spread (to susceptible individuals)
4 example of another factor that became effective; e.g. less money spent on drugs so more for better diet
prevention method described to avoid, food / water, contamination [max 2]

(c) (i) 1 bacterial (surface) antigens / epitopes, act as, non-self / foreign antigens;
2 human cells have self antigens;
3 (antigens are), proteins / polysaccharides;
4 (non-self antigen) will trigger phagocytosis / phagocytes have receptor (only) for, bacterial / non-self, antigens / proteins; **ora** for self antigens
5 ref. to non-self and self antigens containing different sequences of amino acids / self antigens are products of body's genotype / AW;
6 *idea that* phagocytes bind to antibodies complexed with (non-self) antigens (and human cells will not have bound antibody); [max 3]

(ii) *any reasonable; e.g.*
mechanism to prevent, phagosome formation / lysosome fusion with phagocytic vacuole
able to withstand attack by (hydrolytic) enzymes
contain enzyme inhibitors
able to degrade (hydrolytic) enzymes
protective capsule [max 1]

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(iii) reduction in numbers of T (h) lymphocytes; **A** CD_4 (cells) macrophages
ref. to role of T(h) cells e.g. enhanced humoral response, increase macrophage action; lowered immune system / poor immune response / AW; e.g. unable to produce sufficient T/B cells / insufficient stem cells available [max 2]

[Total: 14]

5 **(a)** 1 complementary bases / base pairing, hold(s) strands together / AW;
2 (because of) <u>many</u> hydrogen bonds;
R if between adjacent nucleotides
if mp 1 and 2 not awarded
1/2 hydrogen bonds hold strands together;
3 sugar-phosphate backbone / AW, with covalent / phosphodiester, bonds;
4 double helix structure protects bases;
5 **AVP**; coiling protects from, chemical / enzyme, attack [max 2]

(b) 1 (information is) ref. (different) sequence / order of bases / nucleotides (in the polynucleotide strand);
A described in terms of sequence of bases
2 DNA / gene, contains / AW, information for the synthesis of a, polypeptide / protein / enzyme;
3 *idea that* (coded because) information becomes sequence of amino acids;
4 *idea that* information passed on (cell to cell / parent to offspring); [max 2]

(c) (late) interphase / S phase / synthesis phase; [1]

(d) 1 <u>different</u> sequence of bases / nucleotides;
2 (as a result of) mutation;
3 base <u>substitution</u>;
4 CTT replaced by CAT;
A GAA replaced by GUA (for mRNA codon)
5 glu(tamate) substituted by val(ine); [max 3]

(e) 1 increasing concentration of ara-ATP decreases enzyme activity;
can be comparison between 0 and 5 / 20 or between 5 and 20
A ref. to rate of DNA synthesis for enzyme activity
2 ara-ATP acting as an <u>inhibitor;</u>
3 substrate unable to bind with active site / fewer enzyme-substrate complexes (formed);
4 further detail;
for either competitive
e.g. competes with substrate for (binding to) the active site / similar, structure / shape, as substrate *or* complementary shape to active site
or non-competitive inhibition
e.g. binds to site other than active site / changes shape of active site [max 3]

[Total: 11]

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6 **(a)** *one mark each correct label to max 3;;;* [max 3]

(b) **X** marked over coronary artery section before graft joins; [1]

(c) cure for, coronary artery disease / atherosclerosis in artery;
A arteriosclerosis
so less risk of, myocardial infarction / heart attack / AW;

prevention of coronary artery disease to avoid bypass surgery
one example; e.g. no smoking
increase exercise
low, (saturated) fat / cholesterol, diet
reduce alcohol consumption
reduce salt intake
statins
avoid, excessive / AW, sugar
avoid obesity

ref. to difficulties in getting people to change lifestyle to prevent;

disadvantage of, surgical procedure / cure;
accept ora prevention
e.g. invasive / painful
costly medical
lost time / money, by absence from work
risk of complications / graft rejection / infection
risk / graft becoming diseased / collapsing

AVP; e.g. *idea that* as cure is available, more difficult to encourage prevention [max 3]

[Total: 7]

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1 *accept first on row*
accept phonetic spellings

A *name* mitochondrion ;
A mitochondria

function (site of) ; ATP, synthesis / production / AW
aerobic respiration
link reaction
Krebs cycle
oxidative phosphorylation
AVP
R ATP energy

B *name* Golgi (apparatus / body / complex) ;
A dictyosome **A** Golgi

function (site of) ; modification of protein / glycosylation / described
modification of lipid
pack(ag)ing (of), protein / lipids
production of (Golgi / secretory) vesicles / lysosomes
ignore synthesis of protein
(incorrect name)
lysosome function = contains / storage of hydrolytic / digestive, enzymes
Golgi / secretory, vesicles = transport, protein / lipids

C *name* chloroplast(s) ;

function (site of) ; photosynthesis
light-dependent, reactions / stage (of photosynthesis)
light, absorption / AW
light-independent, reactions / stage (of photosynthesis)
Calvin cycle
carbon fixation
photophosphorylation
A ATP synthesis
ignore *(treat as neutral) ref. to, glucose / oxygen, synthesis*
ignore *chlorophyll*
R light / dark, stage / reactions

D *name* rough endoplasmic reticulum ;
R RER or rough ER **R** endoplastic

function (site of) ; protein / polypeptide, synthesis
translation
modification of protein / described (e.g. folding)
protein transport (to Golgi)
(incorrect name)
smooth endoplasmic reticulum = lipid / steroid / cholesterol, synthesis / AW
endoplasmic reticulum = ecf as above for RER / SER

[Total: 8]

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2 **(a)** cholera and TB ;
ignore *any other underlined diseases* [1]

(b) *must answer in context of antibiotics, not antibodies*
look for bacteria in answer if not clear in mp 1

1 (to ensure) all bacteria are, killed / removed / eliminated / destroyed / AW ;
R virus / bacteria and virus
ignore antigen or pathogen or disease
'all' *may be implied e.g. award if gain mp 2,3,4*
2 (so) no reservoir of infection remains / AW / ora ;
3 (disease) cannot be transmitted / cannot infect others / AW e.g. spread / ora ;
4 no recurrence / disease does not return ; *in context of same person*
5 to reduce chance of / AW, (antibiotic / drug) resistance developing ;
R *idea that human becomes resistant to antibiotics*
6 ref. to mutation in context of resistance ; [max 3]

(c) **(i)** binds with / fits into / AW, active site ; **R** collides with / reacts with
complementary shape to active site / similar shape to substrate ;
A same shape as substrate / same *or* similar structure as substrate
fewer, enzyme-substrate / E – S, complexes ;
A no ESC in context of one enzyme
A fewer successful collisions between enzyme and substrate
A prevents formation of E – S complexes
reduces rate of / slows (enzyme) reaction ;
A reduced enzyme activity / **A** less product formed [max 3]

(ii) *ideas that*
(humans) do not have the enzyme for cell wall synthesis ;
A penicillin only inhibits bacterial enzymes
penicillin will not inhibit any human enzyme ;
(human cells) do not have cell walls ; [max 1]

(iii) cell wall synthesis will stop / slow / be inhibited ;
A inhibit, murein / peptidoglycan, synthesis
ref. to uptake of water by osmosis ;
cell cannot withstand osmotic stress / cell cannot withstand turgor pressure / lysis / bursting / AW ;
A cell wall weakened
bacteria die / are killed / destroyed ;
stops bacteria dividing / reproducing / 'replicating' ;
AVP ; e.g. detail of action of penicillin (e.g. prevents cross-links forming),
(penicillin) only works on growing cells [max 3]

[Total: 11]

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3 (a) *look at quoted data to confirm qualitative statements if unclear*

1 people who never smoked have the lowest percentage of deaths (due to lung cancer) ;
must be comparative

for age

2 *either*
the younger / earlier the person starts smoking the higher the percentage of deaths
or
the older / later the person starts smoking the lower the percentage of deaths
(due to lung cancer) ;

for number of cigarettes per day

3 *either*
increasing / AW, the number of cigarettes smoked per day increases the percentage of deaths
or
decreasing / AW, the number of cigarettes smoked per day decreases the percentage of deaths ;

different 'start' ages for the two types of smokers

4 highest percentage deaths is for those with an early start and smoke, 21–39 (cigarettes per day) / the most / AW ;

5 greatest difference in percentage deaths occurs in those that start smoking early ; **ora**
[max 4]

(b) (i) 1 forms carboxyhaemoglobin ;
2 reduces affinity of Hb for oxygen / Hb has higher affinity for CO than for oxygen ;
ignore 'picks up CO rather than oxygen', if mp3 is given then allow
3 reduces quantity of oxygen transported (in blood) / AW ;
R prevents
4 damages lining of arteries ;
A promotes / AW, atheroma / atherosclerosis / plaque [max 2]

(ii) raises, heart rate / blood pressure ;
reduces diameter of arterioles ;
decreases blood flow to body extremities ;
increases 'stickiness' of platelets / promotes, blood clotting / thrombosis ; [max 2]

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(iii) *goblet cells*
enlarge / swell up ;
A become bigger / dilate
R inflamed
produce more / excess, mucus ;
A lots of
AVP ; e.g. any cellular detail such as more mitochondria / Golgi bodies or vesicles

cilia:
paralysis / destruction ;
A damages **R** kills ***ignore*** 'tar coats…'
no / less beating / sweeping (action) / moving mucus ;
R in context of moving air [max 4]

[Total: 12]

4 **(a)** (×) 400 ;;
if answer incorrect or not to nearest 100 allow one mark for correct working
e.g. (scale bar) 19 000–21 000 divided by 50
award max one mark if a unit (e.g. μm) is included [2]

(b) 1 thick(ened) / lignified, walls prevent, collapse ;
ignore *strenghtened*
A withstands, compression / negative pressure
ignore bursting
2 lignified (wall), prevents leakage / provides waterproofing ;
3 cellulose, wall / lining, allows adhesion of water (molecules) ;
A hydrogen bonding / hydrophilic
4 (relatively) large diameter / large cross-sectional area / wide / large lumen ;
5 hollow / empty / no contents / no cytoplasm ;
6 no end walls / continuous 'tubes' / AW ;
7 elongated ;
A *if referenced to cells or vessels* **A** cells end to end (to make tubes)
only allow mps 4–7 in terms of ease / efficiency of water movement
mp 4 e.g. more space allows a greater volume to flow / greater volume per unit time
or mp 5–6 e.g. *minimal resistance to flow, allows unimpeded flow, allows free flow of water*
8 pits / pitted walls, to allow lateral movement ;
R pores [max 3]

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(c) 1 water moves, down a <u>water potential</u> gradient / from a high(er) water potential to a low(er) water potential, accept ψ for water potential ;
2 apoplast pathway, described / used in correct context ;
3 symplast pathway, described / used in correct context ;
4 evaporation from <u>mesophyll cell walls</u> ;
A surface of mesophyll cells
5 into air space(s) ;
must be linked to evaporation / water vapour
6 water <u>vapour</u> diffuses (out) ;
accept if no vapour but follows from evaporation
7 out / through / via <u>stoma</u>(ta) ;
R 'evaporates from the stomata'
8 **AVP** ; ref. to water leaves unlignified terminals of xylem vessels [max 5]

[Total: 10]

5 **(a)** *all points except mp3 may be taken from a labelled/annotated diagram*
1 ref. to, attachment / AW, to mRNA ;
2 *idea of* two codon attachment, sites / space, for six bases *or* nucleotides ;
3 mRNA has code for sequence of amino acids (in a polypeptide) ;
4 (ribosome) provides sites for attachment of two tRNA (molecules) ;
A implied
5 each tRNA has a specific amino acid / AW ;
6 (mRNA) codon – anticodon (tRNA), binding ;
A description in terms of complementary base pairing
A 'matching'
7 formation of peptide bonds (catalysed by peptidyl transferase) ;
8 *idea of* ribosome moving along mRNA one codon at a time ; [max 4]

(b) **(i)** GGC ; [1]

(ii) CTA ; [1]

(c) 1 amino acid coded by codon 2 changed ;
2 *idea of* every subsequent <u>codon</u> changed ;
3 amino acids / protein sequence, up to and including codon 1 unaffected / AW
ora amino acid sequence from codon 2 onwards is changed ;
4 *idea of* premature chain termination (if stop codon further on) / AW ;
5 *idea of* change in, <u>primary</u> / <u>secondary</u> / <u>tertiary</u>, structure of protein ;
6 *idea of* protein non-functional ;
ignore 'affect / effect'
A in context of enzyme not functioning
R if this point is out of context
7 **AVP** ; e.g. <u>frameshift</u> (mutation) [max 3]

[Total: 9]

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6 **(a)** biotic and abiotic, components / AW ;
A alternatives to biotic and abiotic
including commumity / AW for biotic and habitat / environment, for abiotic
interacting / AW ; *idea of* interactions between organisms *or* interactions between organisms and abiotic environment
in an identifiable / a defined / a self-contained area / place / unit / environment / AW ;
A *idea of place if qualified with correct example* [2]

(b) **(i)** grasses / shrubs / trees ;
A singular or plural [1]

(ii) spider / predatory insect ;
A singular or plural [1]

(c) *energy loss at each level because of*
1 inedible parts / not all of the organism can be eaten ;
2 indigestible parts / not all is digested / egestion / faeces ;
3&4 *energy / heat, losses from* ;;
respiration **R** energy used for respiration
movement **A** energy used for movement
excretion
digestion
ignore *energy not utilised by plants by e.g. reflection from leaves, etc.* [max 3]

(d) *following death of organisms or excretion of nitrogenous waste*
1 decomposers / saprotrophs / bacteria / fungi / scavengers / detritivores ;
2 digest / breakdown / hydrolyse, protein / urea ;
3 *idea of* assimilation in / growth of, decomposers / AW ;
4 deamination ;
5 production of ammonium (ions) / ammonification ; **A** ammonia / NH_3
6 nitrification described *or* denitrification described ;
A formulae for ammonium ions, nitrite ions and nitrate ions but must be correct including signs
A nitrification described in terms of ammonium (ions) to nitrate (ions)
ignore nitrogen fixation as used correctly (N_2 to fixed N)
ignore uptake of nitrate ions or ammonium ions by plants
do not credit nitrification if any confusion with nitrogen fixation [max 3]

[Total: 10]

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