

QUESTIONSHEET 1

- (a) (i) A = cell wall;
B = chromosome/nuclear mass; 2
- (ii) Any two of: free ribosomes/no endoplasmic reticulum/free DNA/no defined nucleus/no organelles/
mitochondria/chloroplast/ Golgi body;; 2
- (b) total of 12 doublings/reproductions;
= 4096; 2
- (c) (i) ribosomes needed to read mRNA/translate mRNA;
unable to carry out protein synthesis; 2
- (ii) ribosomes have different structure/80s ribosomes do not bind to streptomycin; 1
- TOTAL 9**
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QUESTIONSHEET 2

- (a) Any two of: distinct nucleus/nuclear membrane/
smooth/rough endoplasmic reticulum/
mitochondria/ Golgi body;; 2
- (b) Diameter at A = 18 mm; (this may vary with photocopying/printing)
 $\frac{18}{5000}$; = 0.0036 mm or 3.6 μ m; 3
- (c) up to 25° C growth rate becomes faster as rate of enzyme action increases;
highest growth rate at 25 °C due to optimum enzyme action;
at 30° C enzymes inhibited so growth rate slower.; 2
- (d) filter medium containing fungus through paper/nitrocellulose of known (dry) mass;
dry paper/nitrocellulose with fungus at 80-90° C / temperature which evaporates water without burning fungus;
repeat drying and weighing until constant mass; 3
- TOTAL 10**
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QUESTIONSHEET 3

- (a) A - lag;
synthesising enzymes needed to use culture medium/rate of growth of population slower/ few cells dividing
/cells growing but not dividing/microorganism acclimatising to new medium; 2
- B - log;
exponential growth/ numbers double every generation/ logarithmic growth/no limiting factors/qualified optimum conditions; 2
- (b) (i) (longer lag phase) suggests needs additional/different enzymes/sucrose has to be broken down before it can be used
/sucrose takes longer to absorb; 1
- (ii) suggests energy used to obtain energy from sucrose/less carbon available from sucrose than from glucose/
cannot breakdown sucrose effeciently ; 1
- (c) microorganism unable to synthesise the correct enzyme to hydrolyse cellulose; 1
- TOTAL 7**

QUESTIONSHEET 4

- (a) (i) A= RNA;
B= protein; 2
- (ii) TMV has a simple protein coat/capsid but HIV has complex coats of proteins, lipids/glycoproteins;
HIV contains reverse transcriptase but TMV does not; 2
- (b) (i) loss of chlorophyll/chloroplasts reduces photosynthesis;
loss of leaves/reduced leaf surface area reduces photosynthesis/harvestable leaves;
less photosynthesis results in less growth/smaller plants/stunted growth; 3
- (ii) kills virus/destroys infected tissue preventing spread of disease; 1
- TOTAL 8**
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QUESTIONSHEET 5

- (a) 73 cells in grid;(allow range 72 to 74)
volume of grid = $0.2 \times 0.2 \times 0.1 \text{ mm}^3 = 0.004 \text{ mm}^3$;
cells in $1 \text{ mm}^3 = 73 / 0.004 = 18250$; 3
- (b) $18\,250 \times 1000 \times 10^5 = 1.825 \times 10^{12} \text{ cells dm}^{-3}$; 1
- (c) A = little cell division /cells growing but not dividing/bacteria acclimatising to new medium;
enzymes being synthesised to enable medium to be used; 2
- B = population doubling at each generation/exponential growth;
no limiting factors/nutrient/temperature optimum; 2
- C = reproduction rate equals death rate;
limiting factors appear, such as nutrient supply/accumulation of toxins; 2
- TOTAL 10**
-

QUESTIONSHEET 6

- (a) (i) tetracycline kills species X/bacteriocidal;
effect noticeable at 4 hours;
tetracycline has little or no effect on species Y; 3
- (ii) rifamycin has little effect on species X;
little difference from 'without antibiotic' population;
rifamycin increases rate of population growth of species Y; 3
- (b) (i) 1 cm^3 /known volume of culture, added to 9 cm^3 /saline/diluent/broth;
repeat using 1 cm^3 /of first dilution into 9 cm^3 of saline/diluent/broth;
repeat using same volumes until have a number of dilutions; 3
- (ii) 3rd dilution has too many cells so prone to errors in counting;
5th dilution has too few so sampling error too great; 2
- TOTAL 11**

QUESTIONSHEET 7

- (a) sigmoid/S-shaped;
growth slow initially;
exponential growth when no limiting factor;
growth slows as glucose used up/ toxic waste accumulates; 4
- (b) glucose easier to metabolise/enzymes for glucose metabolism already present;
takes time for E coli to metabolise lactose since it must first synthesise lactase; 2
- (c) in presence of lactose bacterial gene for making lactase is switched on;
lactase hydrolyses lactose to glucose and galactose;
galactose can be isomerised to glucose;
glucose is used in respiration/glycolysis; 4
- TOTAL 10**
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QUESTIONSHEET 8

- (a) 1. bacterium a coccus - go to 3
2. bacterium a rod - go to 9
3. coccus pigmented - go to 5
4. coccus not pigmented - go to 7
5. coccus flagellated = Species B
6. coccus not flagellated = Species A
7. coccus flagellated = Species E
8. coccus not flagellated = Species G
9. rod pigmented = Species F
10. rod not pigmented - go to 11
11. rod flagellated = Species D
12. rod not flagellated = Species C 5
- (b) (i) flood slide with crystal violet stain;
wash smear with Gram's Iodine (to fix the stain);
decolourise with alcohol/propanone;
counterstain with carbol fuchsin/safranin; 4
- (ii) crystal violet is retained inside Gr+ cells but washes out of Gr- cells;
because outer wall of Gr+ cells is thick/20 - 80 nm thick compared to Gr- wall which is thin/2 - 3 nm thick; 2
- (iii) Gr+: Staphylococcus/Lactobacillus;
Gr-: E. coli/Pseudomonas; 2

TOTAL 13

QUESTIONSHEET 9

- (a) protein spikes are antigenic/ligands;
protein spikes/ligands on the outer coat only bind specifically to receptors on cells of host;
different species have different receptors; 2
- (b) immunity is short lived/vaccinations are only effective against one strain;
virus mutates frequently and body does not recognise the new antigens; 2
- (c) pandemic spreads world wide, epidemic is more localised/only in one country;
mutation may cause small changes/antigenic drift resulting in epidemics;
or may cause major change/antigenic shift resulting in pandemics;
with antigenic shift few people have immunity while with antigenic drift most people have some immunity; max 3

TOTAL 7**QUESTIONSHEET 10**

- (a) (i)
- | Microorganism | Feature | | | |
|---------------|---------|--------------|-----------|-----------|
| | Nucleus | Mitochondria | Ribosomes | Cell wall |
| Amoeba | ✓ | ✓ | ✓ | ✗ ; |
| Fungi | ✓ | ✓ | ✓ | ✓ ; |
| Bacteria | ✗ | ✗ | ✓ | ✓ ; |
| Viruses | ✗ | ✗ | ✗ | ✗ ; |
- 4
- (ii) nucleic acid/DNA/RNA;
protein; 2
- (b) extracellular digestion;
enzymes secreted into surrounding medium;
ref amylases/proteases/lipases;
large/insoluble molecules hydrolysed/broken down to small/soluble molecules;
small/soluble molecules pass into fungus/hyphae/mycelium by diffusion/active transport;

max 4**TOTAL 10****QUESTIONSHEET 11**

- (a) virus DNA codes for the production of proteins/enzymes;
uses host cell ribosomes to do this;
enzymes destroy the host DNA;
new virus DNA synthesised;
new virus coat/capsid proteins synthesised;
(new) viruses/virions assemble in host cells;
host cell bursts open to release viruses;
(these) infect new/susceptible cells/ref receptor recognition/invasion mechanism; max 6
- (b) (i) virus DNA becomes attached to the host DNA: 1
- (ii) at cell division DNA is replicated;
virus DNA is copied along with host cell DNA;
ref DNA polymerase acts on both host cell and viral DNA;
carried by a chromosome/chromatid into new/daughter cell nuclei; max 3

TOTAL 10

QUESTIONSHEET 12

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|-----|-------|---|---------------------------------------|
| (a) | (i) | A = vacuole; B = nucleus; C = chloroplasts/plastids; | 3 |
| | (ii) | alga cell wall is cellulose, bacterial wall is peptidoglycan/murein/different polymer; | 1 |
| (b) | (i) | protein obtained by collecting and drying whole cells; | 1 |
| | (ii) | ready made supply of nutrients (in sewage treatment tank); thus algae will grow faster/larger; | |
| | | reduces environmental pollution in water; excess minerals/salts in water can cause eutrophication; | |
| | | cheap source of protein; can provide food for people/animals; | (any two pairs of marks) max 4 |
| | (iii) | too little light/too cold (for much of the year); | 1 |
| | | | TOTAL 10 |
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QUESTIONSHEET 13

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|-----|--|--|-----------------|
| (a) | any plasmids replicate; | | |
| | DNA replicates; | | |
| | one (circular) DNA molecule at each end of the cell; | | |
| | new cell wall laid down between DNA (molecules); | | |
| | cytoplasm divided between each new cell; | | max 4 |
| (b) | use chemical compounds/named compound/chemoautotrophs; | | |
| | bond energy used to synthesise organic molecules from inorganic molecules; | | 2 |
| | use light energy/photoautotrophs; | | |
| | convert light energy into chemical bond energy in synthesis of organic molecules from inorganic molecules; | | 2 |
| | secrete extracellular enzymes to digest organic molecules/saprotrophs; | | |
| | absorb soluble organic molecules; | | 2 |
| | | | TOTAL 10 |