

Chapter 1 Practice Questions

[73 marks]

1a.

[4 marks]

Markscheme

- a. surface area of the cell affects the rate of material exchange;
 - b. when the cell increases in size, so does its chemical activity/metabolism;
 - c. (when the cell increases in size/grows) more substances need to be taken in / more waste products need to be excreted;
 - d. as the volume of the cell increases, so does the surface area, however not to the same extent
- OR
- when the cell gets bigger, its surface area to volume ratio gets smaller;
- e. substances will not be able enter the cell fast enough/cell volume will not be supplied
- OR
- metabolic rate will exceed the rate of exchange
- OR
- when the surface area: volume ratio is higher, the diffusion rate increases;
- f. some cells have adaptations to increase their surface area/flatten/microvilli/shape of red blood cells;
- g. cells in growth areas tend to divide and remain small
- OR
- cells divide when maximum size is reached;

1b.

[4 marks]

Markscheme

- a. form of diffusion;
 - b. osmosis is the movement of water molecules;
 - c. (movement) across a selectively/semi/partially permeable membrane/cell membrane;
 - d. from a region of low solute concentration to a region of high solute concentration (until equilibrium is reached)
- OR
- movement of water molecules from a high concentration of water to a low concentration of water molecules;
- e. it is a passive transport mechanism/does not use ATP;
- f. channel proteins/aquaporins are used;

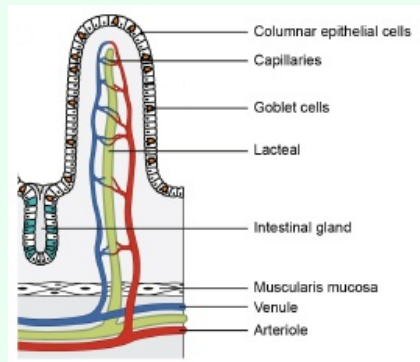
1c.

[7 marks]

Markscheme

- a. small intestine is where nutrients are absorbed into the bloodstream;
- b. very long to maximize absorption;
- c. (the small intestine) is lined with (smooth) muscle to allow for the mixing/ and moving of digested food;
- d. muscles are circular and longitudinal;
- e. that perform peristalsis;
- f. the pancreas (and gall bladder) secretes substances into the small intestine to aid digestion;
- g. contain villi, to increase surface area;
- h. villi have microvilli to increase surface area even more;
- i. villi absorb products of digestion/mineral ions/vitamins/glucose;
- j. dense capillary network rapidly transports absorbed products;
- k. lacteal absorbs lipids from the intestine (into the lymphatic system);
- l. (most of the) chemical digestion (into monomers) occurs in small intestine/description of specific enzyme action;

Accept annotated diagrams as part of the explanation.



[Source: © 1999–2022, Rice University. Except where otherwise noted, textbooks on this site are licensed under a Creative Commons Attribution 4.0 International License <https://creativecommons.org/licenses/by/4.0/>. Image available at <https://openstax.org/books/anatomy-and-physiology/pages/23-5-the-small-and-large-intestines?query=villus&target=%7B%22type%22%3A%22search%22%2C%22index%22%3A0%7D#fsid1272744>]

2a.

[4 marks]

Markscheme

a. theory that eukaryotic cells evolved from prokaryotes

OR

origin of eukaryotic organisms based on some organisms living inside/engulfed by other organisms

OR

prokaryotic cell engulfed another prokaryote including it in cytoplasm without digesting it;

b. mitochondria/chloroplasts have double membranes;

c. mitochondria/chloroplasts have their own DNA/loop of DNA/naked DNA;

d. mitochondria/chloroplasts have similar size to prokaryotes;

e. mitochondria/chloroplasts can reproduce by binary fission;

f. mitochondria/chloroplasts have 70S ribosomes (same as prokaryotes);

2b.

[7 marks]

Markscheme

a. chromosome number is halved so the zygote/offspring has same number as the parent / so that chromosome number is not doubled;

b. process is meiosis;

c. DNA/chromosomes replicate (so each chromosome consists of two chromatids);

d. homologous chromosomes pair in prophase I;

e. (these) separate in anaphase I into two cells;

f. (after meiosis I) cells are haploid;

g. in meiosis II chromatids are separated;

h. result is four haploid cells/gametes;

i. each gamete is genetically unique;

j. (uniqueness) is due to crossing over/independent assortment/random alignment of chromosomes;

k. fertilization results in the formation of a diploid zygote;

l. (fertilization) results in variation in a population

2c.

[4 marks]

Markscheme

a. the binomial system of names for species is universal among biologists
OR

named according to a globally recognized scheme;

b. allows to classify organisms into groups based on similar characteristics/common ancestry/DNA;

c. every species is given a binomial name;

d. members of the same species can mate and reproduce fertile offspring

e. genus is written first, followed by species;

f. genus is capitalized, (followed by) species is lower case

OR

an underlined correct example/stated that it must be underlined or italicized;

3a.

[2 marks]

Markscheme

a. DNA replication ✓

b. cell growth ✓

c. duplication of organelles/mitochondria / production of microtubules/protein synthesis ✓

Accept first two answers only.

3b.

[1 mark]

Markscheme

prophase ✓

The stage should be clearly labelled.

If more than one stage is shown the candidate does not receive a mark

3c.

[1 mark]

Markscheme

anaphase ✓

The stage should be clearly labelled.

If more than one stage is shown the candidate does not receive a mark

3d.

[2 marks]

Markscheme

- a. mitosis produces two daughter cells while meiosis four ✓
 - b. mitosis produces cells with same number of chromosomes ($2n$) while in meiosis they are halved (n) ✓
 - c. mitosis produces body cells but meiosis produces gametes
- OR**
- mitosis produces genetically identical cells but meiosis does not ✓

Allow answers in a table.

Reference to both has to be present for the mark.

3e.

[1 mark]

Markscheme

number of cells (seen under the microscope) undergoing mitosis divided by the total number of cells (observed in sample area) ✓

Can be given as a %.

4a.

[3 marks]

Markscheme

- a. cell wall ✓
 - b. pili/flagella ✓
 - c. 70S ribosomes ✓
 - d. nucleoid / circular DNA
- OR**
- naked DNA ✓
- e. plasmids ✓

*As candidates do not need to know the structure of *Mycobacterium tuberculosis*, all prokaryotic structures are accepted.*

Ignore references to membrane bound organelles.

4b.

[7 marks]

Markscheme

- a. phagocytes/lymphocytes are white blood cells ✓
- b. TB bacterium has a specific antigen ✓
- c. this antigen is recognised by white blood cells ✓
- d. a clone of lymphocytes/plasma cells/B cells are produced ✓
- e. antibodies are produced by lymphocytes ✓
- f. each lymphocyte produces just one type of antibody ✓
- g. (this is) specific immunity ✓
- h. (part of the) antibody/immunoglobulin binds to the antigen / specific antibody binds to the specific antigen ✓
- i. antibodies are proteins/immunoglobulins ✓
- j. (some) plasma cells become memory cells ✓
- k. memory cells reproduce quickly ✓
- l. memory cells prevent infection in the future ✓

Allow annotated diagrams to explain the process.

4c.

[5 marks]

Markscheme

- a. antibiotics block bacterial processes ✓
- b. example of bacterial process ✓ e.g. *cell wall formation*
- c. variations exist naturally in a population / some are naturally resistant to the antibiotic ✓
- d. bacteria that are not resistant to this antibiotic will die / only resistant will survive (when antibiotic given) ✓
- e. this characteristic could be passed to next generation ✓
- f. (natural selection) leads to changes in the proportions/frequency in the population ✓
- g. human population will be exposed to antibiotic resistant bacteria and will not have antibiotic to kill them ✓
- h. (antibiotic resistant bacteria) may pass resistance to other bacteria species/types by means of plasmids (so other bacteria species turn resistant too) ✓

5a.

[2 marks]

Markscheme

$$\frac{\text{scale bar length}}{\text{image size}} = \times 660 \checkmark$$

5b.

[2 marks]

Markscheme

- a. the Davson-Danielli model proposed two layers of protein on either side of a lipid bilayer ✓ *OWTTE*
- b. micrographs illustrate proteins in and/or crossing the membrane ✓

5c.

[2 marks]

Markscheme

- a. amphipathic means that they are both hydrophilic and hydrophobic ✓
 - b. the outside hydrophilic parts are exposed to water ✓
 - c. hydrophobic parts are away from water in the inside ✓
- Water or lack of needs to be mentioned for mpb*

6a.

[4 marks]

Markscheme

- a. DNA is unwound/strands are separated «by RNA polymerase» ✓
- b. new nucleotides attached to template strand «by RNA polymerase» ✓
- c. complementary base pairing/base pairing with an example
OR
adenine with thymine/uracil with adenine/cytosine with guanine/guanine with cytosine ✓
- d. mRNA detaches from template ✓
- e. DNA rewinds ✓

6b.

[4 marks]

Markscheme

- a. facilitated diffusion by channel proteins ✓
- b. active transport by protein pumps
OR
protein pumps *eg* sodium-potassium ✓
- c. cell recognition by glycoproteins/protein receptors ✓
- d. communication/receptors for hormones/signal molecules ✓
- e. cell adhesion ✓
- f. allow up to one additional mark for AHL material ✓

6c.

[7 marks]

Markscheme

- a. natural selection is caused by selection pressures in the environment
OR
example of a selection pressure ✓
- b. natural selection requires that variation exists within a species ✓
- c. variation arises randomly due to mutation
OR
variation is enhanced by meiosis/sexual reproduction ✓
- d. over-production of offspring promotes selection
OR
natural selection occurs when there is
competition/overpopulation/predators/environmental changes/changes in
selection pressures ✓
- e. well adapted individuals/individuals with best variations survive to
reproduce/survival of fittest ✓
- f. «frequency of» genes/alleles conferring an advantage are selected for
OR
genes/alleles conferring a disadvantage are selected against ✓
- g. genetic divergence/difference increases
OR
natural selection «genetically» isolates members of a species so eventually
they can no longer produce fertile offspring ✓
- h. genetic divergence» leads to reproductive isolation ✓
- i. geographical/behavioural/ecological factors may lead to «reproductive»
isolation ✓
- j. prolonged «reproductive» isolation leads to speciation ✓
- k. up to one additional mark for AHL information ✓

© International Baccalaureate Organization 2022

International Baccalaureate® - Baccalauréat International® - Bachillerato Internacional®



Printed for INTL SCH INNSBRUCK