Chapter 1 IB Review 2017 Free Answer *[75 marks]*

1a. State **two** differences in structure between plant and animal cells. *[2 marks]*

Markscheme

Plant cells	*Animal cells*
chloroplasts/plastids	no chloroplasts/plastids;
cell wall	no cell wall;
large (central) vacuole	no large (central)vacuole;
no centrioles	centrioles;
no lysosomes	lysosomes;

Answers do not need to be shown in a table format.

1b. Outline how molecules move across a membrane by simple diffusion. *[2 marks]*

Markscheme

membranes are porous/permeable allowing diffusion;
diffusion is (passive) movement (of particles) from high to low concentration;
due to random motion/kinetic energy of molecules / no ATP involved;
diffusion continues until concentrations are equal (across the membrane);

1c. Explain the role of protein pumps in active transport. *[2 marks]*

Markscheme

(can) move solutes against a concentration gradient;
using energy/ATP;
specific for the solute/molecule transported;
protein pumps change shape (as they transport molecules);

2a. State the mode of transport if water moves into the cell. *[1 mark]*

Markscheme

osmosis

2b. State the mode of transport if sodium ions move into the cell. *[1 mark]*

Markscheme

active transport

2c. Explain facilitated diffusion. *[3 marks]*

Markscheme

movement down the concentration gradient / from high to low concentration;
through channel proteins/ion channels;
passive transport / it requires no energy from the cell / no ATP;
for molecules that cannot pass through the phospholipid bilayer;
channel is specific/selective to the ion/molecule being transported;

2d. State the name of the structures formed within a cell by endocytosis. *[1 mark]*

Markscheme

vesicles / vacuoles / endosome

3a. Draw a labelled diagram to show the structure of membranes. *[5 marks]*

Markscheme

*Award **[1]** for each structure clearly drawn and correctly labelled.*
phospholipid bilayer – with head and tails;
hydrophilic/phosphate/polar heads and hydrophobic/hydrocarbon/fatty acid/ non-polar tails labelled;
integral protein – embedded in hydrophobic region of the phospholipid bilayer;
channel protein – integral protein showing clear channel/pore;
peripheral protein – on the surface (not embedded in hydrophobic region) can be attached to integral protein;
glycoprotein – with carbohydrate attached on outside;
cholesterol – shown embedded in bilayer;

3b. Explain the importance of surface area to volume ratio as a factor limiting cell size. *[7 marks]*

Markscheme

as volume of a cell increases, the ratio of its surface area to volume decreases;
food/oxygen enters through the surface of cells;
wastes leave through the surface of cells;
the rate of substance crossing the membrane depends on surface area;
more metabolic activity in a larger cell means more food and oxygen required;
large volume means longer diffusion time;
(large volume) means more wastes produced;
excess heat generated will not be lost efficiently (with low surface area to volume ratio);
eventually surface area can no longer serve the requirements of the cell;
this critical ratio stimulates mitosis;
(thus) the size of the cell is reduced and kept within size limits;

4a. State the name of each phase shown, recording whether each phase has taken place at an early or intermediate stage of mitosis. *[2 marks]*

Phase A: . . . . . .occurs at an. . . . . stage
Phase B: . . . . . .occurs at an. . . . . stage

Markscheme

phase A: anaphase (*occurs at an*) intermediate (*stage*); (*both needed*)
phase B: prophase (*occurs at an*) early (*stage*); (*both needed*)

4b. Outline the events occurring in phase A. *[2 marks]*

Markscheme

centromeres split/break;
(sister) chromatids/chromosomes separate;
dragged/pulled/movement to separate poles;
by shortening of spindle microtubules;
Do not allow events other than those in anaphase

4c. State what results when there is an uncontrolled division of cells in living organisms. *[1 mark]*

Markscheme

tumours / cancer

4d. DNA in chromosomes undergoes replication before mitosis. Outline how complementary base pairing is important in this process. *[2 marks]*

Markscheme

conservation of the base sequence of DNA;
adenine pairs with thymine and cytosine pairs with guanine; (*do not accept initials only*)
both (daughter) cells/DNA strands produced have identical genetic information;

5a. State the stage of mitosis typified by image II. *[1 mark]*

Markscheme

anaphase

5b. List **two** processes that involve mitosis. *[2 marks]*

Markscheme

a. growth (through increasing cell number);

b. embryonic development;

c. tissue production/repair;

d. (asexual) reproduction;

5c. State the process that results in tumour (cancer) formation or development. *[1 mark]*

Markscheme

uncontrolled mitosis/cell division

5d. Explain, using **one** example, how non-disjunction in meiosis can lead to changes in chromosome number. *[2 marks]*

Markscheme

a. pair of homologous chromosomes moves in same direction/does not separate during anaphase I / chromatids move in same direction/do not separate during anaphase II;

b. leaving a cell with an (some) extra chromosome(s)/missing chromosome(s);

c. an example; *(e.g. Down syndrome where there is an extra chromosome number 21);*

6a. List **two** functions of membrane proteins. *[2 marks]*

Markscheme

a. hormone binding sites / receptors;

b. (immobilized) enzymes;

c. cell adhesion;

d. cell (to cell) communication;

e. passive transport/channels;

f. active transport/pumps;

g. facilitate diffusion;

h. carry electrons;

6b. Explain why digestion of large food molecules is essential. *[1 mark]*

Markscheme

a. many molecules are too large to be absorbed (by the villi) / small molecules are soluble and can be absorbed;

b. large food molecules are broken down so they can be reorganized/rearranged;

6c. Outline why antibiotics are effective against bacteria but not against viruses. *[2 marks]*

Markscheme

a. antibiotics block/inhibit specific metabolic pathways/cell functions found in bacteria;

Accept specific examples of inhibition such as cell protein synthesis, cell wall formation

b. viruses must use host/eukaryotic cell metabolism / viruses do not have their own metabolic pathways;

c. host/eukaryotic cell metabolism/pathways not blocked/inhibited by antibiotics;

6d. Outline the use of polymerase chain reaction (PCR) to copy and amplify minute quantities of DNA. *[2 marks]*

Markscheme

a. strands of DNA (fragments) split/denatured with heat;

b. complementary nucleotides added to split stands (when cooling);

c. with the use of (DNA) polymerase (and primers);

d. process/heating and cooling cycle is repeated (until enough DNA is obtained);

Accept example of PCR application e.g. paternity cases or forensic investigations.

7a. Draw a labelled diagram of the ultrastructure of *Escherichia coli* as an example of a prokaryote. *[4 marks]*

Markscheme

Award [1] for each structure clearly drawn and correctly labelled.

a. cell wall; *(with some thickness)*

b. plasma membrane; *(shown as single line or very thin)*

c. cytoplasm;

d. pilus/pili; *(shown as single lines)*

e. flagellum/flagella; *(shown as thicker and longer structures than pili and embedded in cell wall)*

f. 70S ribosomes;

g. nucleoid / naked DNA;

h. approximate width 0.5μm / approximate length 2.0μm;

Award [4 max] if the bacterium drawn does not have the shape of a bacillum (rounded-corner rectangle with length approximately twice its width).

Award [4 max] if any eukaryotic structures included.

7b. Describe the events that occur in the four phases of mitosis in animals. *[6 marks]*

Markscheme

Accept the following points as a diagram if clearly drawn and correctly labelled.

a. supercoiling of chromosomes in prophase;

b. chromosomes consist of sister chromatids in prophase;

c. formation of mitotic spindle / centrosomes/centrioles move away in prophase;

d. nuclear membrane breaks down in (late) prophase/(early) metaphase;

e. attachment of spindle microtubules to centromeres;

f. chromosomes on metaphase plate/equator/centre of cell in metaphase;

g. parting of (sister) chromatids at onset of anaphase;

h. movement of sister chromosomes *(accept chromatids)* to opposite poles in anaphase;

i. re-formation of nuclear membranes in telophase;

Award [5 max] if response does not mention all four phases of mitosis.

7c. Explain the process of aerobic cell respiration after glycolysis has occurred. *[8 marks]*

Markscheme

a. pyruvate produced by glycolysis;

b. pyruvate enters mitochondrion/mitochondria;

c. pyruvate loses CO_2 in link reaction;

d. and $NADH+H^+$;

e. with formation of acetyl CoA;

f. to take part in Krebs cycle;

g. where two CO_2 are produced (per molecule of pyruvate);

h. one ATP from ADP+Pi;

i. along with (three) $NADH+H^+$ (and one $FADH_2$);

j. $NADH+H^+$ provide electrons circulating in the electron transport chain on the inner mitochondrial membrane;

k. allowing H^+ to accumulate in the intermembrane space;

l. and come back to the matrix through ATP synthase/synthetase to produce ATP (by chemiosmosis);

m. presence of O_2 required as the final electron acceptor for the electron transport chain;

n. producing water with H^+;

8a. State the property of stem cells that makes them useful in medical treatment. *[1 mark]*

Markscheme

has the ability to differentiate (into specialized tissue)

8b. Explain how multicellular organisms develop specialized tissues. *[2 marks]*

Markscheme

only some genes are expressed in each cell type/tissue;
tissues therefore develop differently/become differentiated;
example of differentiated cell and the function of tissues;

8c. Outline some of the outcomes of the sequencing of the human genome. *[3 marks]*

Markscheme

knowledge of location of human genes / position of human genes on chromosomes;
knowledge of number of genes/interaction of genes / understanding the mechanism of mutations;
evolutionary relationships between humans and other animals;
discovery of proteins / understanding protein function / detection of genetic disease;
leads to the development of medical treatment/enhanced research techniques;
knowledge of the base sequence of genes/study of variation within genome;

9a. Explain how materials are moved across membranes of cells by active transport. *[2 marks]*

Markscheme

transport against a concentration gradient / from low to high concentration;
through protein pumps;
uses energy/ATP;

9b. Explain the effects of pH on enzyme catalysed reactions. *[3 marks]*

Markscheme

enzymes have a pH optimum;
active site works best at this pH;
activity decreases above and below the optimum;
by interfering with H-bonding/active site structure;
denaturing by extremes of pH so enzyme activity/reaction stops;

9c. Distinguish between the process of anaerobic respiration in yeast and humans. *[2 marks]*

Markscheme

yeast: pyruvate to ethanol and carbon dioxide;
humans: pyruvate to lactic acid;
*Award **[1 max]** if products are appropriately linked to organisms without the mention of pyruvate.*