

Chapter 2 Practice Questions

[106 marks]

1a.

[3 marks]

Markscheme

a. protein formed from amino acids

OR

20 different amino acids ✓

b. linked together by peptide bonds ✓

c. may consist of one or more polypeptides linked together ✓

d. have a specific shape/conformation/folding ✓

e. shape determines function ✓

1b.

[7 marks]

Markscheme

a. protein is produced when a gene is expressed / switched on ✓

b. genetic code/codons consists of three nucleotides/bases/base triplet ✓

c. genetic code in DNA is transcribed/transcription (to mRNA) ✓

d. mRNA exits the nucleus ✓

e. mRNA (code) is translated/translation into a polypeptide/protein ✓

f. amino acid sequence/polypeptide formation occurs at a ribosome ✓

g. one codon translates to one amino acid ✓

h. tRNA carries code for specific amino acids ✓

i. tRNA anticodon matches with specific codon in mRNA ✓

j. amino acids joined (by peptide bonds) to form polypeptide ✓

k. sequence of amino acids determined by order of bases/nucleotides/codons in DNA/mRNA ✓

l. proteins vary based on which amino acids are used and their order

OR

protein variety increases by mutations to DNA ✓

1c.

[5 marks]

Markscheme

- a. enzymes that catalyse/speed up/control (the rate and direction of) metabolic reactions ✓
 - b. proteins can be hormones which are chemical messengers to cells ✓
 - c. proteins that transport through the membrane such as channel/carrier/pumps / that regulate what enters/leaves the cell ✓
 - d. hemoglobin in red blood cells that transports/ binds oxygen ✓
 - e. membrane proteins for cell/tissue recognition/cell adhesion/communication ✓
 - f. structural elements of muscle fibre/actin/myosin for movement
OR
spindle fibres move chromosomes ✓
 - g. histones condense DNA into chromosomes ✓
- The question requires answer that the function is in cells.*

2a.

[5 marks]

Markscheme

- a. starch is a carbohydrate ✓
- b. starch is formed by carbon, hydrogen and oxygen ✓
- c. it is a polymer/chain/polysaccharide ✓
- d. formed from monosaccharides/simple sugars/glucose ✓
- e. linked together by condensation/dehydration ✓
- f. consists of amylose and amylopectin ✓
- g. amylose is a long chain/unbranched ✓
- h. amylopectin is branched ✓

2b.

[7 marks]

Markscheme

- a. food is mechanically/physically digested in the mouth through mastication/chewing ✓
- b. mixed with saliva (to form the bolus) in mouth ✓
- c. moved through esophagus/peristalsis ✓
- d. proteins digested in the stomach (pepsin) ✓
- e. pancreas secretes enzymes into lumen of small intestine
OR
(endo)peptidases/trypsin) are secreted by pancreas ✓
- f. enzymes digest macromolecules to monomers
OR
endopeptidases digest polypeptides to peptides/amino acids ✓
- g. villi of small intestine absorb amino acids ✓ *Allow pepsin.*
- h. amino acids carried to blood capillaries ✓
- i. blood (capillaries) carry amino acids to (hepatic portal) vein/blood vessel going to liver ✓
- j. amino acids absorbed by active transport/protein pumps in the villi ✓

2c.

[3 marks]

Markscheme

- a. gametes of both parents shown as a capital and small letter (e.g. L and l) ✓
- b. possible F1 genotypes ✓
- c. 25 % lactose intolerant, 50 % carriers, 25 % lactose tolerant
OR
75 % tolerant and 25 % intolerant
OR
child has 25 %/1:4/ $\frac{1}{4}$ chances of inheritance of intolerance ✓

	L	l
L	LL	Ll
l	Ll	ll

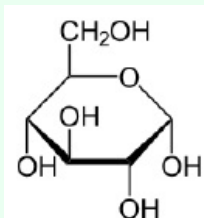
3a.

[3 marks]

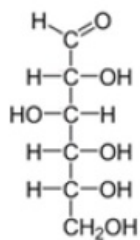
Markscheme

- a. hexagonal ring structure with O at one point (between C1 and C5);
 - b. correct orientation of OH groups (on carbons 1 to 4); *Hydrogens not required*
 - c. CH₂OH group shown on fifth carbon with correct orientation;
 - OR**
 - d. 6 carbon chain with oxygen on first C;
 - e. H and OH groups correctly orientated;
- Carbons do not need to be numbered.*

Allow boat or chair diagrams.



OR



Allow [2 max] if linear structure drawn.

3b.

[5 marks]

Markscheme

- a. occurs by the process of photosynthesis;
- b. occurs in chloroplasts of plant cells/using chlorophyll;
- c. chlorophyll absorbs red/blue light **AND** reflects green light; *Both needed for marking point.*
- d. raw materials/starting products are carbon dioxide and water/shown in an equation;
- e. water is split by photolysis;
- f. oxygen is produced as waste/by-product/lost;
- g. glucose formed/shown in an equation;
- h. glucose molecules combine to form starch for storage;
- i. light energy transformed to chemical;

Markscheme

- a. autotrophs/producers convert carbon dioxide into carbohydrates/carbon compounds in photosynthesis;
- b. carbon dioxide diffuses/moves from the atmosphere /water into autotrophs/plants;
- c. carbon compounds are transferred through food chains/*OWTTE*;
- d. carbon dioxide produced by respiration diffuses out of organisms into water/atmosphere;
- e. decomposers release carbon dioxide during decay/putrefaction;
- f. methane is produced from organic matter in anaerobic conditions (by methanogens);
- g. some methane diffuses into the atmosphere/accumulates in the ground;
- h. methane is oxidized to carbon dioxide (and water) in the atmosphere;
- i. peat forms when organic matter is not fully decomposed because of acidic/anaerobic conditions in waterlogged soils;
- j. partially decomposed organic matter from past geological eras/fossils was converted into coal/oil/gas that accumulated in rocks;
- k. carbon dioxide is produced by the combustion of biomass/fossilized organic matter/fuels;
- l. hard parts of some animals/corals/molluscs are composed of calcium carbonate
- m. can become fossilized in limestone;

As this is an “explain” question, simply drawing a labelled diagram is not enough for [7]. Diagram would need sufficient annotations to meet the command term.

If carbon compounds are referred to instead of carbon dioxide, penalise once then ecf.

4a.

[4 marks]

Markscheme

- a. simple diffusion is passive movement of molecules/ions along a concentration gradient ✓
- b. facilitated diffusion is passive movement of molecules/ions along a concentration gradient through a protein channel «without use of energy» ✓
- c. osmosis is the passage of water through a membrane from lower solute concentration to higher ✓ *OWTTE*
- d. active transport is movement of molecules/ions against the concentration gradient «through membrane pumps» with the use of ATP/energy ✓ *Active transport requires mention of the use of energy.*
- e. endocytosis is the infolding of membrane/formation of vesicles to bring molecules into cell with use of energy
OR
exocytosis is the infolding of membrane/formation of vesicles to release molecules from cell with use of energy ✓
- f. chemiosmosis occurs when protons diffuse through ATP synthase «in membrane» to produce ATP ✓

The description of each type of transport should include the name and brief description.

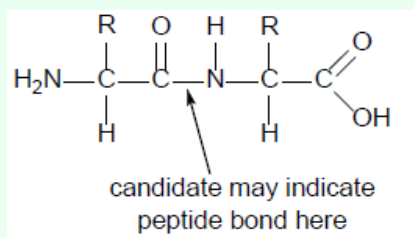
mpa, mpb and mpc require reference to concentration.

4b.

[3 marks]

Markscheme

- a. two amino acids, one with $\text{NH}_2/\text{NH}_3^+$ end and one with COOH/COO^- end ✓
- b. peptide bond between $\text{C}=\text{O}$ and $\text{N}-\text{H}$ correctly drawn ✓
- c. «chiral» C with H and R group on each amino acid ✓
- d. peptide bond labelled/clearly indicated between C terminal of one amino acid and N terminal of the second amino acid ✓



Labels not required for amino group and carboxyl group.

4c.

[8 marks]

Markscheme

- a. enzymes catalyse/speed up chemical reactions/lower the energy needed ✓
OWTTE
 - b. have specific active sites to which specific substrates bind ✓
 - c. enzyme catalysis involves molecular motion and the collision of substrates with the active site ✓ *OWTTE*
 - d. enzymes break macromolecules into monomers/smaller molecules indigestion ✓
 - e. smaller molecules/monomers more readily absorbed ✓
 - f. <<pancreas>> secretes enzymes into the «lumen of» small intestine ✓
 - g. the small intestine has an alkaline pH ✓
 - h. enzymes have maximum action at specific pHs
OR
enzymes can be denatured at other pHs ✓
 - i. amylase breaks down starch into sugars/disaccharides ✓
 - j. lipase breaks lipids/triglycerides into monoglycerides/fatty acids and glycerol ✓
 - k. endopeptidase/protease breaks «peptide» bonds in proteins/polypeptides ✓
 - l. accept any other valid pancreatic enzyme, substrate and product ✓
- Award [6 max] if there is no mention of two specific groups of enzymes.*

5a.

[3 marks]

Markscheme

- a. eukaryotes evolved from prokaryotes ✓
- b. prokaryotes engulfed other prokaryotes without digesting them ✓
- c. engulfed aerobic cell/prokaryote became mitochondria ✓
- d. engulfed photosynthetic cell/ prokaryotes became chloroplasts ✓
- e. these organelles have a double membrane «due to the engulfing process» ✓
- f. mitochondria/chloroplasts contain DNA/small ribosomes/70S ribosomes ✓

5b.

[4 marks]

Markscheme

- a. solar/light energy is converted to chemical energy ✓
- b. energy needed to produce glucose ✓
- c. only specific wavelengths are absorbed by chlorophyll
OR
red and blue absorbed most strongly.
OR
chlorophyll is the pigment that absorbs light energy ✓
- d. $H^{(+)}$ /electrons from water are used to reduce compounds ✓
- e. CO_2 is absorbed/used/reduced to produce carbohydrates ✓
- f. correct word/balanced symbol equation of photosynthesis ✓
Accept correct reference to NADPH/ATP from AHL.

Markscheme

control: [6 max]

- a. homeostasis is the maintenance of a constant internal environment ✓
- b. the pancreas produces hormones that control the levels of glucose ✓
- c. if glucose levels in blood are high, beta-cells «of the pancreas» produce insulin ✓
- d. «insulin» causes the cells to take up /absorb glucose ✓
- e. liver stores excess glucose as glycogen ✓
- f. if glucose levels in blood are low, alpha-cells «of the pancreas» produce glucagon ✓
- g. «glucagon» causes the liver to break down glycogen into glucose ✓
- h. «glucagon» increase levels of glucose in the blood ✓
- i. negative feedback controls the glucose levels ✓ *OWTTE*

consequences:

- j. if the pancreas produces little/no insulin a person can develop type I diabetes ✓
- k. a person with type I diabetes «usually» needs/is dependent on injections of insulin ✓
- l. type II diabetes occurs when the body becomes resistant to insulin/cells do not respond to insulin ✓
- m. type II diabetes can «sometimes» be controlled by diet and exercise ✓
- n. named consequence of having diabetes «eg: eye damage» ✓

Award [6 max] if no consequences are given.

6a.

[3 marks]

Markscheme

a. COO- **or** COOH group at one end

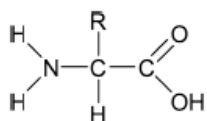
b. NH₂ **or** NH₃⁺ at the other

c. CH in middle with H or R group attached

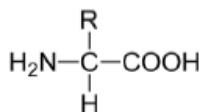
If shown expanded, then carbonyl oxygen must attach to C

If shown non-expanded, N of amine group must attach to C

eg:



OR



6b.

[4 marks]

Markscheme

a. translation is the production of polypeptides/proteins

b. mRNA binds to the ribosome

c. tRNA binds to the ribosome

d. at the site where its anti-codon corresponds to the codon on the mRNA

OWTTE

e. amino acids of «consecutive tRNAs» bind by a peptide link «in the ribosomes»

f. the ribosome moves along the mRNA

OR

continues with elongation of polypeptide chain

Accept annotated diagrams of the process.

6c.

[8 marks]

Markscheme

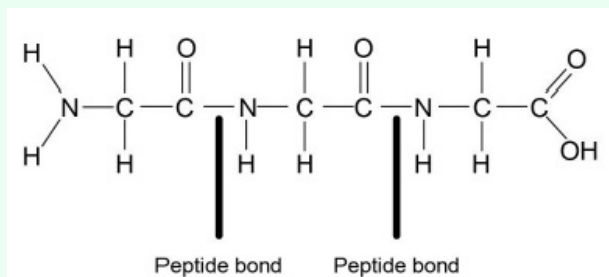
- a. clotting factors «are proteins» that initiate the clotting cascade/process
 - b. fibrin «is a protein that» permits blood clotting
OR
allows the formation of a clot
 - c. «the protease» thrombin converts fibrinogen to fibrin
OWTTE
 - d. fibrin forms a mesh/clot that prevents the entry of pathogen/antigen into the blood
 - e. antibodies are «specific» proteins that lymphocytes make
 - f. each antibody corresponds to a specific pathogen/antigen
OR
antibodies are specific «to certain pathogens/antigens»
 - g. antibodies create specific immunity
 - h. plasma cells produce large amounts of «specific» antibodies
OR
memory cells retain the ability to produce «specific» antibodies
 - i. immunoglobulins are antibodies against pathogens
 - j. enzymes in phagocytic white blood cells may digest pathogens
- Accept annotated diagrams of the process.*

7a.

[1 mark]

Markscheme

circle/bracket around peptide bond / arrow pointing to peptide bond / peptide bond labelled;



Allow either peptide bond

Allow if adjacent $\text{C}=\text{O}$ and NH groups are included in the circle/bracket, but do not allow if other parts of the molecule are included

7b.

[3 marks]

Markscheme

- a. Rubisco fixes CO₂ from atmosphere during photosynthesis;
- b. insulin controls blood glucose levels;
- c. collagen forms connective tissue/ligaments;
- d. spider silk forms the spider web;
- e. rhodopsin involved in photoreceptor;
- f. immunoglobulins/antibodies attach to antigens/pathogens;
- g. actin/myosin performs muscle contraction;
- h. hemoglobin carries oxygen in red blood cells;

Accept any other correct **three named** proteins

If an enzyme is named, the correct substrate must be stated

7c.

[1 mark]

Markscheme

contracts/flattens/becomes less domed/increases volume of thorax;

8a.

[1 mark]

Markscheme

25

Accept 24.5 to 26.

Units not required.

8b.

[2 marks]

Markscheme

- a. BMI could indicate if a person is overweight/obese/too heavy for their height;
- b. overweight/obesity increases the probability of developing type II diabetes;

Do not accept "High BMI increases the risk of diabetes."

9a.

[1 mark]

Markscheme

«three bases on mRNA» coding for one amino acid «in a polypeptide» ✓

9b.

[1 mark]

Markscheme

met-ser-arg-arg

OR

start-ser-arg-arg

OR

met-ser-arg-arg-stop

OR

start-ser-arg-arg-stop ✓

Do not accept peptides containing an amino acid/leu for the last codon.

9c.

[1 mark]

Markscheme

TAC TCG GCT TCC ATC GAC ✓

9d.

[1 mark]

Markscheme

they occurred after the common origin of life *OWTTE*

OR

the genetic code is not «in fact» universal ✓

Look for alternatives.

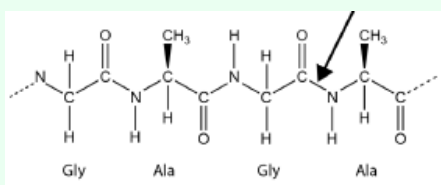
9e.

[1 mark]

Markscheme

any annotation between a C=O and the next NH ✓

e.g.



9f.

[1 mark]

Markscheme

condensation ✓

Do not accept anabolism alone.

9g.

[2 marks]

Markscheme

	c	d
	Function	Conformation
Rubisco	enzyme/catalyst / carbon fixation / <i>OWTTE</i>	globular ✓
Spider silk	absorb stretch/structural / <i>OWTTE</i>	fibrous/longitudinal /linear/«mainly»β-pleated ✓

Award [1] per correct row or correct column.