Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2013

Biology

Assessment Unit AS 1

assessing

Modules and Cells

[AB111]

WEDNESDAY 9 JANUARY, MORNING

MARK SCHEME

/ denotes alternative points
; denotes separate points
Comments on mark values are given in bold
Comments on marking points are given in italics

Section A

1 Ribosomes/rough endoplasmic reticulum;
Golgi apparatus;
lysosomes;
plasmodesmata;
nucleolus; [5] 5

2 **(a)** Similarities
Any two from
- both contain only carbon, hydrogen and oxygen
- both are produced by condensation reactions/are broken down by hydrolysis reactions
- both may be used as energy storage/release energy during respiration *[both contain/produce energy is not acceptable]*
- both are insoluble/have no osmotic effect

Differences
Any two from
- polysaccharides are carbohydrates (starch, glycogen and cellulose) while triglycerides are lipids (fats and oils)
- polysaccharides are made from monosaccharides (glucose) while triglycerides contain glycerol and fatty acids
- polysaccharides are polymers/many monomers, triglycerides are not
- polysaccharides contain glycosidic bonds, while triglycerides contain ester bonds
- fats contain much less oxygen than polysaccharides
- fats contain more energy per gram than polysaccharides
- triglycerides are hydrophobic, polysaccharides are not [4]

(b) Iodine (for starch) and Clinistix (for glucose); [1] 5

3 **(a)** **(i)** Centromere/kinetochore; [1]

(ii) S/synthesis phase (of interphase); [1]

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

(ii) Paired homologous chromosomes/bivalents attached to spindle;
chiasmata/crossing over (that formed during prophase) visible; [2]

(c) Chromatids pulled apart *[chromatids shown as V-shaped, with centromeres pointing towards poles]*;
with attached spindle fibres missing the sections between the chromatids (with other spindle fibres complete); [2] 7

4 **(a)** **A**: Columnar epithelium cell;
B: goblet cell/mucus secreting cell;
C: microvilli/brush border;
D: nucleus/nucleoplasm/chromatin; [4]

(b) Magnified length = 82 mm;
= 82 000 µm;
82 000 ÷ 2050 = 40 µm; [3]

(c) **Two appropriate organelles with relevant explanation**
Mitochondria;
to provide ATP for active transport *[insist on ATP, not energy]*;
or
ribosomes/rough ER;
for manufacture of digestive enzymes/carrier proteins/channel proteins/glycoproteins;
or
Golgi body;
to produce vesicles carrying enzymes/carrier proteins/channel proteins/glycoproteins;
or
vesicles;
containing small proteins absorbed by pinocytosis/proteins produced by rough ER (or Golgi body);
or
lysosomes;
to digest proteins/bacteria taken in (by endocytosis); [4] 11

5 **(a)** **(i)** Secondary structure: helices evident in polypeptide chains;
Quaternary structure: three (more than one) polypeptide chains present; [2]

(ii) The arrangement of polypeptide chains/triple helix provides (tensile) strength *[must relate structure to strength]*; [1]

(b) Hydrophobic amino acids found in interior/at Y;
orientated away from cytoplasm/extracellular fluid/because water present to exterior; [2]

(c) **(i)** Solute potential would be increased/made less negative; [1]

(ii) Red blood cells would absorb water/swell/may burst (haemolyse);
because the cell cytoplasm would have a lower water potential than the plasma; [2]

(iii) Water potential is higher in the blood plasma than within the cavity (tissue fluid)/water is not being (osmotically) moved into the blood because of the lack of albumen in the blood; [1] 9

6 **(a)** Caption (the effect of increasing temperature on the rate of reaction of a protease enzyme);
independent variable (temperature) on x-axis and appropriate scaling;
label on each axis, with appropriate units;
accurate plotting of points and points joined with short, straight lines; [4]

(b) **(i)** Somewhere between 50 °C and 60 °C (51 °C to 60 °C); [1]

(ii) Carry out experiment at smaller intervals between 50 °C and 60 °C/70 °C; [1]

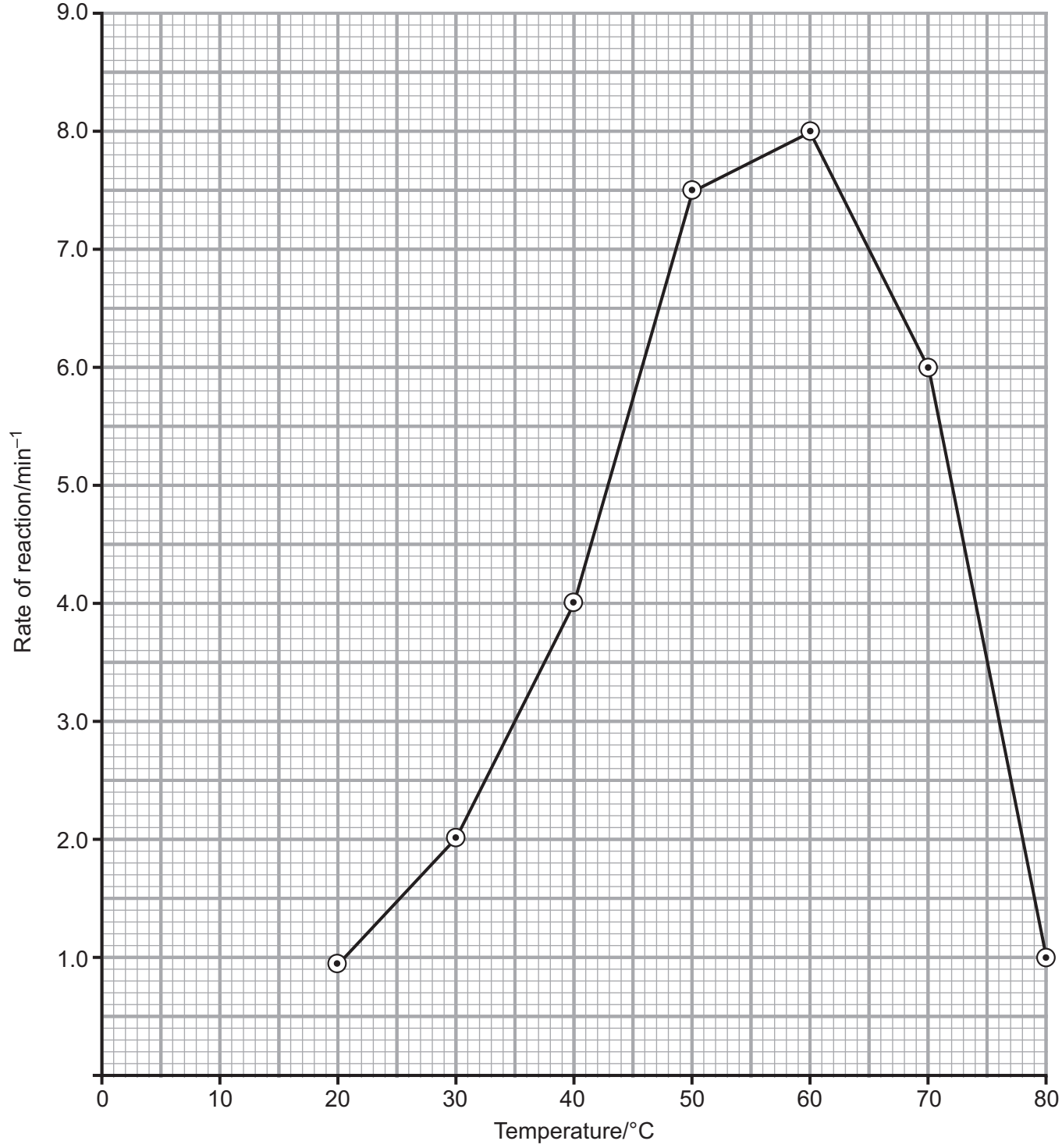
(iii) Enzyme has been extracted from thermophilic bacteria (with more disulfide bonds)/enzyme has been immobilised/enzyme is synthetic/ 10 minutes may not be sufficient time to denature enzyme (below 60 °C); [1]

(c) To allow enzyme and substrate to reach the reaction temperature before being mixed; [1]

(d) **(i)** Use of pH buffer; [1]

(ii) At optimum pH the active site is most complementary (for the binding of the substrate)/at other pHs the active site is less complementary;
reference to effect on ionic bonds within enzyme molecule; [2] 11

The effect of increasing temperature on the rate of reaction of a protease enzyme

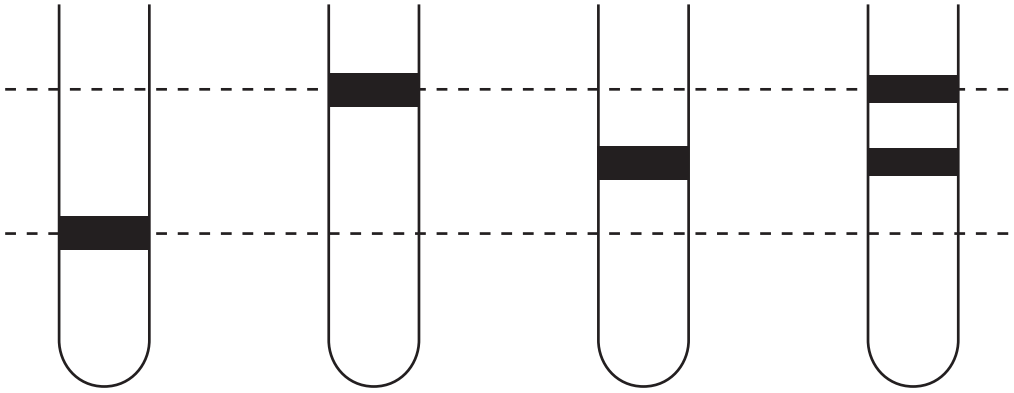


7 **(a)** **A**: hydrogen bond;
B: phosphodiester bond/covalent; [2]

(b) In a new DNA molecule, one strand is conserved from the parent molecule; while the other strand is newly synthesised (from free nucleotides); [2]

(c) **(i)** (Nitrogenous/organic) bases; [1]

(ii) Following one generation: one intermediate band drawn;
Following two generations: two bands drawn – one intermediate and one light;



DNA with ^{15}N only | DNA with ^{14}N only | Following **one** generation in ^{14}N | Following **two** generations in ^{14}N

[2]

(iii) In each molecule of DNA, one strand contains heavy nitrogen (^{15}N)/ is the parental strand, while the other contains light nitrogen (^{14}N)/is the new strand; [1]

(d) **(i)** PCR/polymerase chain reaction; [1]

(ii) It is thermostable/heat-stable; [1]

(iii) **Any two from**
- genetic fingerprinting (profiling)
- scene of crime analysis/forensic science
- paternity testing
- genetic screening/testing
- sequencing DNA
- detection of viral/bacterial DNA
- ancestral/phylogenetic relationships
- other appropriate response [2]

12

Section A **60**

Section B

8 (a) Five marks, with a maximum of four from either part

Similarities
- both non-cellular/lacking typical cellular structure
- both possess a head/capsid composed of protein
- genetic material (DNA/RNA) is located inside capsid/protein coat
- both very small (up to 200 nm approx.)/visible only with electron microscope

Differences
- HIV roughly spherical, while bacteriophage (capsid) is icosahedral (or drawn/described)
- HIV capsid is within a lipid envelope (absent in bacteriophage)
- HIV genome is made of RNA, while bacteriophage genome is made of DNA
- HIV contains the enzyme reverse transcriptase
- bacteriophage has a tail section/(consisting of) a protein sheath around a core/(and) tail fibres attached to a base plate (absent in HIV)
- different proteins on exterior allow each virus to invade different cells
- HIV has glycoproteins, while bacteriophages do not [5]

(b) Eight marks, with a maximum of six differences

Similarities
- both possess a cell membrane/cytoplasm (cytosol)
- cell membrane has fluid mosaic structure/composed of phospholipids and proteins
- both possess ribosomes
- both possess DNA
- both may contain glycogen

Differences
- bacterial cell is much smaller (up to 10 µm) than an animal cell (up to 100 µm)
- a cell wall surrounds a bacterial cell, but not an animal cell
- bacterial cell may also have a capsule/pili
- cell membrane of an animal cell contains cholesterol (absent in bacterial cell membrane)
- ribosomes in a bacterial cell are smaller than those in an animal cell
- DNA linear in an animal cell while bacterial DNA is circular
- DNA associated with histone/proteins in animal chromosomes while bacterial DNA lacks protein (is naked)
- bacterial cells may contain plasmids, while animal cells do not
- genetic material is enclosed in a nuclear membrane in animal cells/they possess a nucleus
- bacterial cell contains no membrane-bound organelles/membrane systems, while animal cell does (e.g. mitochondria/endoplasmic reticulum/Golgi body/lysosomes) ***[not** chloroplasts]*/bacteria are prokaryotic while animal cells are eukaryotic
- centrioles/mitotic spindle/microtubules present in animal cells, but not in bacterial cells [8]

Quality of written communication

2 marks:
The candidate expresses ideas clearly and fluently through well linked sentences, which present relationships and not merely list features.
Points are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.

1 mark:
The candidate expresses ideas clearly, if not always fluently. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.

0 marks:
The candidate produces an account that is of doubtful relevance or obscurely presented with little evidence of linking ideas. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the account. [2] | 15

Section B | **15**

Total | **75**