

Structure and replication of DNA

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Nucleic acids and protein synthesis
Sub Topic	Structure and replication of DNA
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : 46 minutes

Score : / 38

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

Question	Expected Answers	Marks
1	<p>(a) W cytosine;</p> <p>X deoxyribose;</p> <p>Y nucleotide (triphosphate);</p>	[3]
	<p>(b) base pairing/A-T <u>and</u> C-G; A purine - pyrimidine</p> <p>ref to complementary/explained with ref to H bonds; R complementary in wrong context</p> <p>(free) nucleotides pair with both, strands/each strand/polynucleotides/sides;</p> <p>both strands act as templates;</p> <p>to produce two DNA molecules that are identical to one another;</p>	[max 3]
	<p>(c) (all nuclei/cells) are <u>genetically</u> identical; A genetic stability, same genetic information, exact genetic material, genetic material does not vary, same genotype;</p> <p>no mutation;</p> <p>any consequence of mutation;</p> <p>e.g. cells not recognised, cells divide uncontrollably, substitution of 1 amino acid result in disease e.g. sickle cell anaemia, enzyme's active site altered, forms different protein with different function.</p>	[max 2]
		[Total: 8]

CHEMISTRY ONLINE
— TUITION —

- 2 (a) (i) box drawn round one phosphate, sugar and base ; [1]
- (ii) label P to circle ; **A** phosphate / no label but clear a circle is intended [1]
- (b) 1 DNA (double helix), unwinds / AW ; **A** uncoil
- 2 hydrogen bonds between (complementary) bases broken ;
ignore DNA unzips
- 3 complementary, base / nucleotide, pairing ; **A** A-T and C-G
- 4 phosphodiester bonds ;
- 5 both strands used as templates ; **A** both strands are copied
- 6 produces two identical DNA molecules ; **A** 'DNAs'
- 7 semi-conservative / each new DNA = one 'old' and one 'new' strand ;
- 8 ref to DNA polymerase ;
- 9 correct ref to other named enzyme ; e.g. helicase (unwinds), topoisomerase (cuts backbone), ligase (formation of phosphodiester bonds)
- 10 ref to Fig. 5.1 ; e.g. described dotted lines as H bonds that need to be broken
look for annotations on Fig. 5.1
- 11 AVP ; e.g. replication fork(s), replication bubble(s), antiparallel nature, Okazaki fragments, activated nucleotides (3 phosphate groups) [max 5]
- (c) 1 tRNA carries amino acid to ribosome ;
- 2 ref to specificity of amino acid carried ;
- 3 anti-codon on tRNA complementary to codon on mRNA ;
A example for complementary, e.g. AUG and UAC
- 4 ref to two sites / P(eptidyl) and A(mino-acyl) sites, of ribosome ;
- 5 peptide bond is formed between amino acids ; **R** 'polypeptide bond'
- 6 tRNA, can be re-used / collects another amino acid ; [max 3]

[Total: 10]

CHEMISTRY ONLINE
— TUITION —

- 3 (a) (i) adenine ;
(ii) ribose ; R pentose [2]
- (b) 1 energy is released when it is hydrolysed ; A equation A joules for energy
2 easily hydrolysed ;
3 (energy) used in, processes / reactions ; A named process
4 rapid turnover ;
5 links catabolic and anabolic reactions / AW ;
6 found in, most cells / all organisms ;
7 soluble so easily moved (within cell) ;
8 ATP produced from variety of reactions ; A named reactions [4 max]
- (c) 1 ETC / inner mitochondrial membrane / crista / stalked particles ;
2 grana / thylakoids / inner chloroplast membrane ;
3 cytoplasm / cytosol ;
4 mitochondrial matrix ; [2 max]

[Total: 8]

- 4 (a) *plant cell because presence of*
 cell wall ; **A** cellulose cell wall **R** incorrect cell wall materials
 plasmodesma ; **A** plasmodesmata
 tonoplast ; **A** vacuolar membrane
 large/central, vacuole ; **ignore** permanent [2 max]

(b)

name of organelle	diagram of organelle(s) as seen under the electron microscope (not to scale)	one function of organelle	cell type(s) in which organelle is located
	<i>all 3 for one mark</i> oval/circular shape <u>and</u> two membranes close together <u>and</u> inner membrane infolded as two or more cristae ;	<u>aerobic</u> respiration/ATP, production/synthesis ; A oxidative phosphorylation A ref. β oxidation fats A ref. urea/ornithine cycle R any answer that refers to synthesis/production, of energy	
centrioles ; A centriole A centrosome			animal ;
	<i>both for one mark</i> two membranes <u>and</u> ribosomes on external surface ; R if ribosomes are excessively large		animal and plant/both ;
		processing/modification/AW/ packaging, of, proteins/ molecules ; A description of modification e.g. glycosylation A production of, <u>secretory/ Golgi, vesicles</u> A production of lysosomes R protein synthesis	
chloroplast ;			

[8]

[Total: 10]