A-Level Biology

Paper 4

Unsolved Topical

Past Papers with Marking Schemes

All Variants

2014-2021

Title A-LEVEL TOPICAL BIOLOGY PAPER 4

Published by MS Books (042-35774780)

Legal Advisor Ashir Najeeb Khan (Advocate)
AKBAR LAW CHAMBERS
39-40, 1st Floor, Sadiq Plaza, The Mall, Lahore.
0307-4299886, 042-36314839

For Complaints/Order **MS Books**
83-B, Ghalib Market, Gulberg III Lahore
(042-35774780),(03334504507),(03334548651)

Price **Rs.**

Preface

Excellence in learning can't be claimed without application of concepts in a certain context. In this regard one of the perfect approach is to start logically in chunks; like chapter wise learning and applying it on exam based questions.

This booklet provides an opportunity for practice of exam based questions which has been classified on the basis of syllabus topics and more precisely on teacher's recommendation basis. Extensive working of Team MS Books has tried to take this booklet to perfection by:

- Removing all the repeated questions but added their references at relevant places.
- Keeping all the question in a hierarchy from early years to most recent years.
- Adding Answering Key / Marks Scheme at the end of each topic.
- Maintaining actual spacing between consecutive questions and within options as per CIE format which gives students a more realistic feel of attempting question.

In addition to all this; review, feedback and contribution in this booklet by various competent teaches of subject belonging to renowned school chains make it most valuable resource and tool for both teachers and students. With all believes in strengths of this resource material I can confidently claim its worth in achieving brilliance.

Subject Head

Muhammad Shahid

0334-4463339

M.Phil (FSQM), B.S (Biology), B.S.Ed (Education) Biology Teacher at SLC (SICAS Liberty Complex)

In case of any suggestion for improvement Team Head can be contacted at

TABLE OF CONTENTS

Energy & Respiration

Q8/43/M/J/14

1 **(a)** A mitochondrion contains DNA and ribosomes and is the organelle in which aerobic respiration takes place.

Suggest the functions of the DNA and ribosomes **in a mitochondrion**.

....

....

....

....

....

....

....

....[3]

(b) Oxidative phosphorylation takes place in the mitochondrion.

Different stages of oxidative phosphorylation are listed below.

They are **not** listed in the correct order.

stage	description of stage
Q	protons diffuse through the channel protein into the matrix
R	a proton gradient is set up across the crista
S	hydrogen atoms split into protons and electrons
T	protons combine with electrons and oxygen atoms to form water
U	electrons are passed from carrier to carrier
V	reduced NAD releases hydrogen atoms to cytochrome carriers
W	energy from electron transfer is used to pump protons into the intermembrane space
X	ATP synthase produces ATP

Complete Table 8.1 to show the correct order of the stages.

Two of the stages have been done for you.

Table 8.1

correct order	letter of stage
1	**V**
2	....
3	....
4	....
5	**R**
6	....
7	....
8	....

[4]

(c) ATP can be converted to ADP and inorganic phosphate by the enzyme ATPase.

State the **type** of reaction taking place.

.... [1]

(d) Some parasitic worms, such as tapeworms, live in a mammalian gut where there is no oxygen.

Suggest how a tapeworm produces ATP in this environment.

....

....

....

....

....

....

....

....

....

....

.... [5]

[Total: 13]

MS BOOKS

Q5/42/O/N/14

2 **(a)** Fig. 5.1 shows the structure of an ATP molecule.

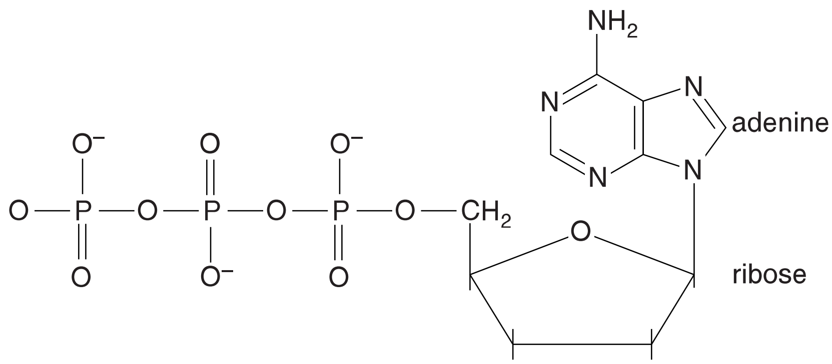

Fig. 5.1

State two ways in which the structure of ATP differs from the structure of an adenine nucleotide in a DNA molecule.

1. ....

....

2. ....

....[2]

(b) In respiration, energy from various substrates is used to synthesise ATP.

(i) Explain why less ATP can be synthesised from the same mass of glucose in anaerobic respiration than in aerobic respiration.

....

....

....

....

....

....

....

....[3]

MS BOOKS

(ii) Explain why more ATP can be synthesised in aerobic respiration from one gram of lipid than from one gram of glucose.

....

....

....

....

....

....

....[3]

[Total: 8]

Q4/43/O/N/14

3 (a) All living organisms require a continuous supply of energy.

Outline the need for energy in living organisms.

....

....

....

....

....

....[2]

(b) Fig. 4.1 is a diagram of ATP.

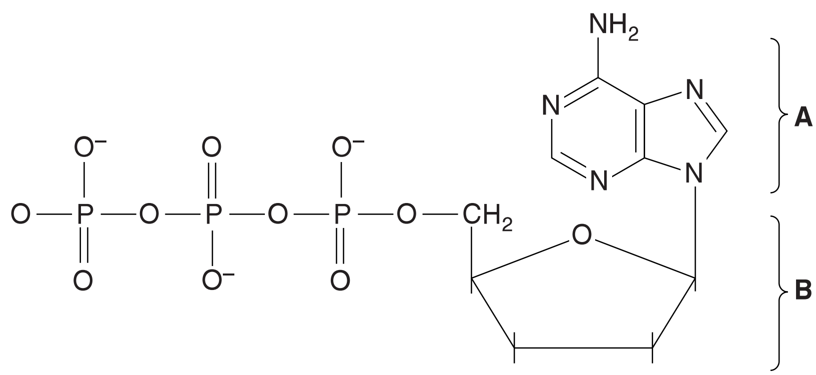

Fig. 4.1

(i) Name **A** and **B**.

A ....

B .... [1]

(ii) Describe how the structure of ATP is related to its role as energy currency.

....

....

....

....

....

....

....[3]

(c) *Thermus thermophilus* is a bacterium found in geothermal environments, such as hot springs. The bacterium respires **aerobically**, even though at high temperatures the solubility of oxygen in water is low.

(i) Explain how **aerobic** respiration may be affected by a decrease in oxygen availability.

....

....

....

....

....

....[2]

(ii) One strain of *T. thermophilus*, HB8, has an enzyme, nitrate reductase, which allows nitrate to be used as the final electron acceptor in the electron transport chain (ETC).

Suggest an advantage to the bacterium of this adaptation.

....

....[1]

(d) A mutant strain of HB8 (HB8 mutant) was made by adding an insertion mutation to the gene that codes for the enzyme nitrate reductase.

An investigation was carried out into population growth of HB8 and of HB8 mutant in aerobic and in anaerobic conditions. In each experiment, a flask containing bacterial culture medium was incubated. Table 4.1 shows how the flasks were set up.

The number of bacteria of each strain per cm^3 was calculated after 20 hours.

Table 4.1

flask	bacteria	conditions
1	HB8	aerobic
2	HB8 mutant	aerobic
3	HB8 and HB8 mutant	aerobic
4	HB8	anaerobic
5	HB8 mutant	anaerobic
6	HB8 and HB8 mutant	anaerobic

MS BOOKS

The results are shown in Fig. 4.2.

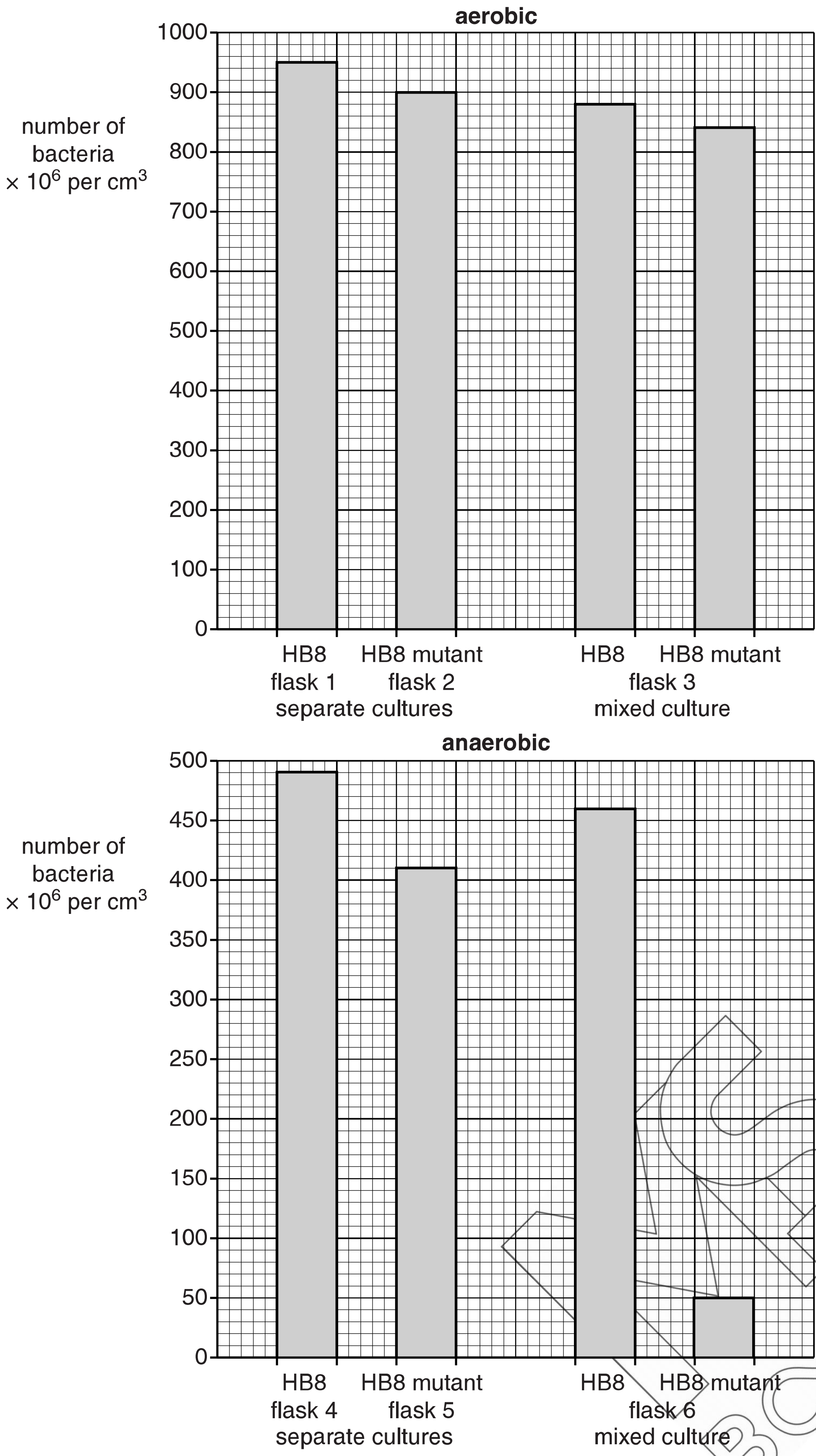

Fig. 4.2

(i) Compare the growth of the two strains of bacteria in aerobic and anaerobic conditions in **separate** cultures.

....

....

....

....

....[2]

(ii) Compare the growth of the two strains of bacteria in aerobic and anaerobic conditions in **mixed** cultures.

....

....

....

....

....[2]

(iii) Suggest an explanation for the results shown in flask 6.

....

....

....[1]

[Total: 14]

Q8/43/M/J/14 **Q 1**

(a) (DNA for) transcription / codes for mRNA ;
(ribosomes for) translation **;**
synthesis of, respiratory enzymes / named enzyme / inner membrane proteins **;** [max 3]

(b)

correct order	letter of stage
1	**V**
2	**S**
3	**U**
4	**W**
5	**R**
6	**Q**
7	**X**
8	**T**

S U W all above **R ;**
S U W in correct order ;

Q X T all below **R ;**
Q X T in correct order **;** [4]

(c) hydrolysis / dephosphorylation / exothermic / exergonic ; [1]

(d) anaerobic respiration **;**

substrate level phosphorylation (in glycolysis);

at triose phosphate ⟶ pyruvate step ;

(net) gain of 2ATP (per glucose) ; **A** 2 used and 4 produced

pyruvate, reduced / gains hydrogens (from reduced NAD) ;

forming lactate **;**

NAD regenerated / $NADH_2$ re-oxidised **;**

this allows glycolysis to continue **;**

I ethanol pathway [max 5]

[Total:13]

Q5/42/O/N/14 **Q 2**

(a) contains ribose (not deoxyribose) **;**

has three phosphate groups (not one) **;** [2]

(b) **(i)** *anaerobic – accept **ora** for aerobic*

1 *idea that* glucose not completely, broken down / oxidised
or
only glycolysis occurs **;**

2 pyruvate / lactate / ethanol, still contains energy **;**

3 ETC stops **;**

4 (because) no oxygen to act as (final) electron acceptor **;**

5 (so) no, Krebs cycle / link reaction / oxidative phosphorylation / chemiosmosis **;** [max 3]

(ii) 1 lipid contains (relatively) more, hydrogen atoms / C-H **;**

2 detail **;** e.g. molecular formula of glucose and a lipid given

3 more reduced, NAD / FAD, produced **;**

4 more electrons passed along ETC **;**

5 more hydrogen ions pumped across inner mitochondrial membrane / more hydrogen ions pumped into intermembrane space / steeper proton gradient **;** [max 3]

[Total: 8]

Q4/43/O/N/14 **Q 3**

(a) *ignore ref. to energy currency*

1 *idea of* synthesis of complex substances or synthesis of named large molecule / anabolic reactions**;**

2 transport of substances against concentration gradient / active transport **;**

3 movement qualified **;** e.g. muscle contraction / cilia movement / locomotion

4 AVP **;** e.g bioluminescence, electrical discharge, temperature regulation [max 2]

(b) **(i)** *both answers required for one mark*

A adenine **R** adenosine

B ribose / pentose **;** [1]

(ii) 1 small **;**

2 water soluble **;**

3 easily transported around the cell **;**

4 easily hydrolysed (to release energy) **;**

5 (so) relatively large quantity of energy released / 30.5 $kJ\,mol^{-1}$ **;**

6 *idea of*, rapid turnover / small cellular ATP content is sufficient for cell's requirements **;** [max 3]

(c) **(i)** 1 less / decreased (aerobic respiration) **;**

2 oxygen, is the final electron acceptor / needed for ETC **;**

3 oxidative phosphorylation decreased / chemiosmosis decreased **;**

4 regeneration of NAD / Kreb's cycle / link reaction, decreased **;**

5 ATP synthesis decreases / ATP synthetase activity decreased **;** [max 2]

(ii) more ATP produced (for population growth) **;** [1]

(d) **(i)** 1 HB8 always does better than mutant HB8 **;**

2 HB8 and mutant HB8 both do better in aerobic than in anaerobic conditions **;**

3 data quote to support **;**

for mp1
[950 $\times$ 10^6 per cm^3 v 900 $\times$ 10^6 per cm^3] **and** [490 $\times$ 10^6 per cm^3 v 410 $\times$ 10^6 per cm^3] **or** manipulated figures

for mp2
[950 $\times$ 10^6 per cm^3 v 490 $\times$ 10^6 per cm^3] **and** [900 $\times$ 10^6 per cm^3 v 410 $\times$ 10^6 per cm^3] **or** manipulated figures [max 2]

(ii) 1 both grow better in aerobic compared to anaerobic **;**

2 *ref. to* significant difference found in mutant HB8 (aerobic compared to anaerobic) **;**

3 data quote to support **;**

for mp1
[880 $\times$ 10^6 per cm^3 v 460 $\times$ 10^6 per cm^3] **and** [840 $\times$ 10^6 per cm^3 v 50 $\times$ 10^6 per cm^3] **or** manipulated figures

for mp2
[840 $\times$ 10^6 per cm^3 v 50 $\times$ 10^6 per cm^3] **or** [460 $\times$ 10^6 per cm^3 v 50 $\times$ 10^6 per cm^3] **or** manipulated figures [max 2]

(iii) *idea that* HB8 is a better competitor than mutant HB8 **;** **ora**

in mutant HB8 activity of, enzyme / nitrate reductase, is reduced **;** [max 1]

[Total: 14]