Name	Date started	Target end date

GCE A LEVEL — BIOLOGY UNIT 3 QUESTION PACK

1074 (Legacy BY4) + 1075 (Legacy BY5) · New spec Unit 3 Topic 1 · A2 unit, first sat 2017, 90 marks, 2h paper

REVISE
.wales

BIOLOGY — UNIT 3 · ATP — STRUCTURE & CYCLE

3.1 The importance of ATP — molecular structure, the ATP–ADP cycle and the universal energy currency

ATP as a nucleotide-derived molecule (adenine, ribose, three phosphate groups), the high-energy phosphoanhydride bonds, the ATP–ADP hydrolysis / synthesis cycle, and the many roles of ATP across metabolism, active transport, anabolism and muscle contraction.

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~51 min

Derived from the legacy BY4 / BY5 papers' pace of ~1.3 min/mark, padded for long-prose answers (32 marks over 3 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY4 (and BY5, where relevant) papers (2008 modular spec, 2011–2017) that maps onto new-spec A2 Unit 3 Topic 1 (3.1).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

For Examiner's use only

Q	Source	Max	Mark
1	BY4 Jun 11 Q1	10	
2	BY4 Jan 12 Q2	13	
3	BY4 Jun 17 Q2	9	
	Total	**32**	

ATP — Structure & Cycle — what the new spec asks

WJEC GCE A Level Biology (from 2015) · Unit 3: Energy, Homeostasis & the Environment · Topic 3.1.

ATP structure

- Nucleotide-derived: adenine + ribose + three phosphates.
- Phosphoanhydride bonds between phosphates store energy.
- Hydrolysis of terminal phosphate releases ~30.5 kJ/mol.

ATP–ADP cycle

- ATP → ADP + P_i + energy — energy used for cell work.
- ADP + P_i + energy → ATP — energy from respiration / photosynthesis.
- Rapid turnover — cells use ~kg of ATP per day.

Uses of ATP

- Active transport (Na^+/K^+ pump, proton pumps).
- Anabolism (protein, DNA, polysaccharide synthesis).
- Muscle contraction; nerve impulse transmission; bioluminescence.

Synthesis sites

- Mitochondrion (oxidative phosphorylation, by far the largest yield).
- Chloroplast (photophosphorylation in the light reactions).
- Cytoplasm (small yield from glycolysis & fermentation).

Crib sheet »

ATP — Structure & Cycle in one page

Quick-reference notes — revisit before each question.

ATP molecule

Adenine + ribose + 3 phosphates.

Two phosphoanhydride bonds — high-energy.

Hydrolysis releases ~30.5 kJ mol^{-1}.

ATP ↔ ADP cycle

ATP → ADP + P_i — energy out.

ADP + P_i → ATP — energy in (respiration / photosynthesis).

Cells turn over ~kg ATP per day.

Why ATP?

Universal energy currency.

Small amount released per molecule — suits cell needs.

Immediately available; doesn't need long pathway.

Uses

Active transport (Na/K pump, proton pumps).

Anabolic synthesis (protein, DNA).

Muscle contraction, nerve impulse, bioluminescence.

Sources

Substrate-level: glycolysis + Krebs.

Oxidative phosphorylation (mitochondria).

Photophosphorylation (chloroplasts).

Phosphorylation

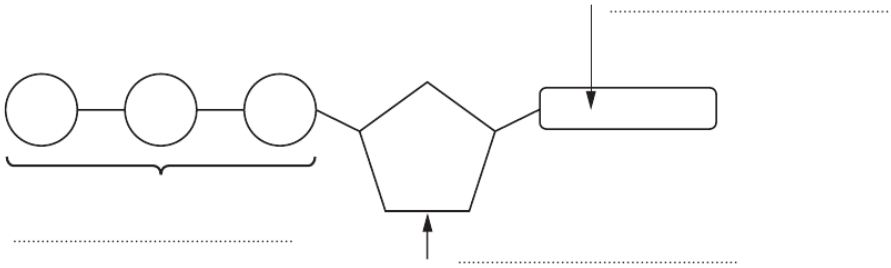
Substrate-level: P transferred directly to ADP.

Oxidative: ETC + ATP synthase.

Photophosphorylation: light-driven ETC.

Examiner only

1. The diagram below shows a molecule of ATP.



(a) (i) Label the component parts of the molecule. [2]

(ii) Give the full name of the molecule. [1]

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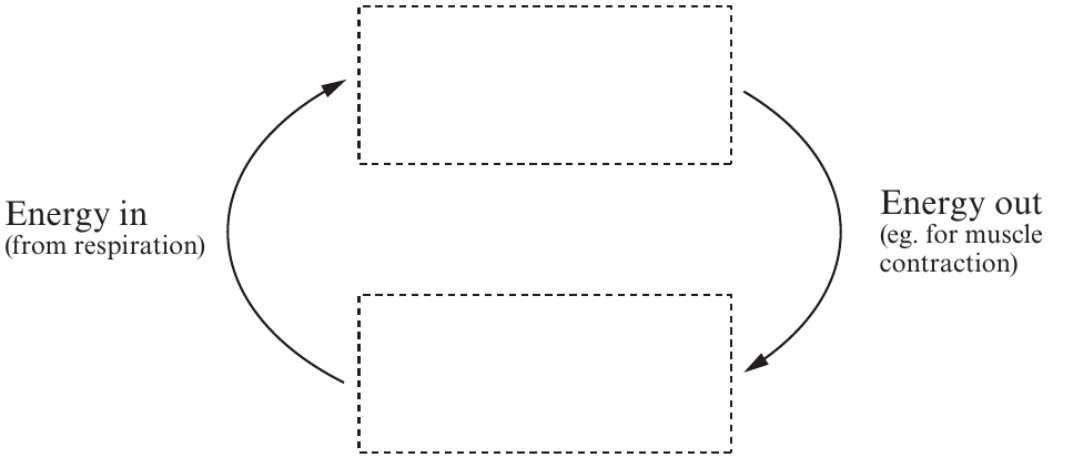
(b) (i) In the spaces indicated below, use drawings similar to the one above to show the changes that this molecule undergoes in cells. [1]



(ii) Apart from muscle contraction, name **one** *other* process in cells which requires energy. [1]

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Examiner only

(c) There are four main stages in the production of ATP by **aerobic** respiration.

(i) Complete the table below to show where the listed stages take place and how many molecules of ATP and reduced cofactor are produced from one molecule of glucose. [2]

Stage	Precise location in cell	Number of molecules of ATP	Number of molecules of $NADH_2$	Number of molecules of $FADH_2$
Glycolysis	cytoplasm	2 (net)	2	0
Link reaction				
Krebs cycle				

(ii) Name the fourth stage and give its precise location in the cell. [1]

Name of stage .....

Precise location in the cell .....

.....

(iii) State the number of ATP molecules this stage produces for one molecule of each type of reduced cofactor. [1]

$NADH_2$ .....

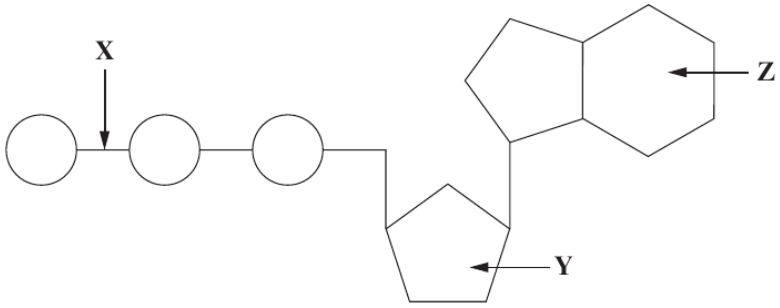
$FADH_2$ .....

(d) Complete the word equation below to show the products of **anaerobic** respiration in yeast cells. [1]

(Total 10 marks)

Examiner only

2. *(a)* The diagram represents a molecule of ATP.



(i) Give the name of the reaction which has resulted in the bond **X**. [1]

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(ii) Name the pentose sugar **Y**. [1]

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(iii) Name the organic base **Z**. [1]

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(b) Describe how energy is released from ATP. [3]

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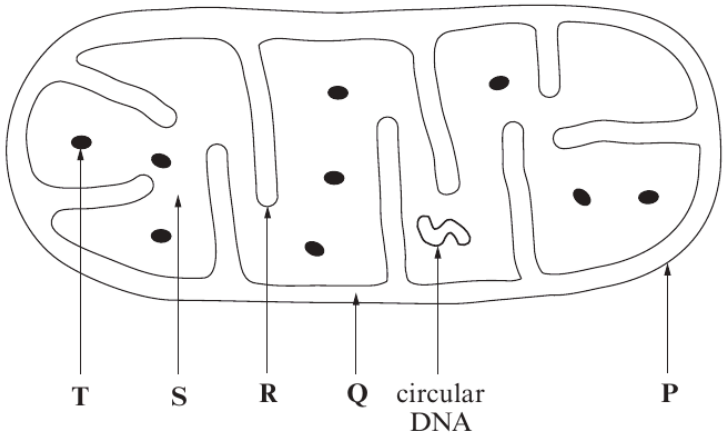
Examiner only

(c) (i) The diagram shows the structure of a mitochondrion as seen using an electron microscope.



Using the letters on the diagram identify the site of each of the following: [3]

I. Krebs cycle; .....

II. oxidative phosphorylation; .....

III. decarboxylation. .....

(ii) What is the function of the circular DNA? [1]

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(iii) Explain how the pH in region **Q** becomes acidic. [3]

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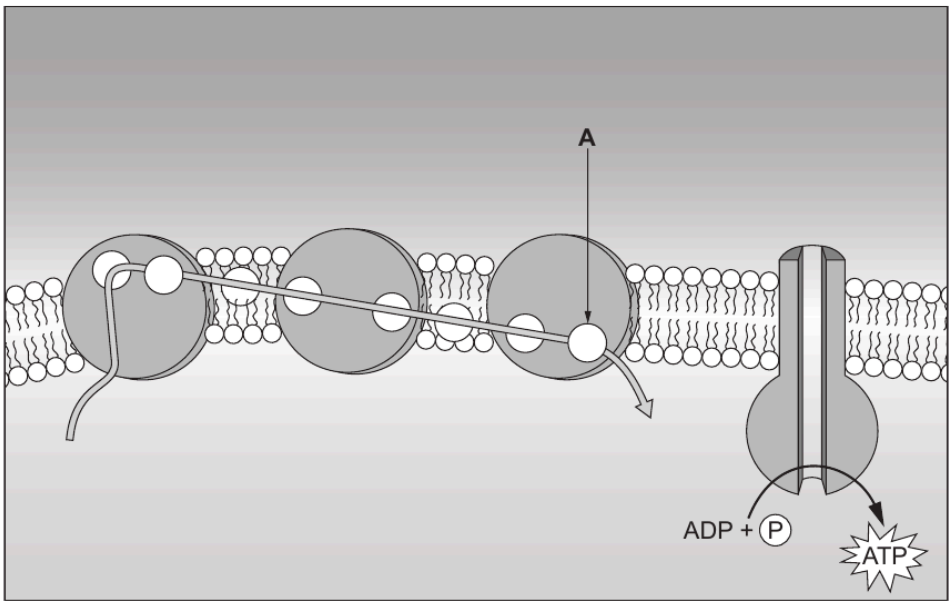
(Total 13 marks)

Examiner only

2. The diagram below shows the sequence of events which occur in ATP synthesis in a mitochondrion.



(a) Name this sequence of events and explain how it leads to the synthesis of ATP. [5]

Examiner only

(b) Cyanide binds to a molecule at position **A** in the diagram. Explain how this would affect ATP synthesis. [2]

(c) Arsenic inhibits pyruvate dehydrogenase. Explain the effect this would have on the sequence of events in the diagram. [2]

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END OF QUESTION PACK

3 questions · 32 marks · ~51 min
Source: WJEC BY4 + BY5 (2008 modular spec, 2011–2017)
Curated for WJEC Biology 2015 spec A2 Unit 3 — Topic 1 (3.1)