

# 12.1 Energy

## Question Paper

Course	CIEA Level Biology
Section	12. Energy & Respiration
Topic	12.1 Energy
Difficulty	Hard

**Time allowed:** 40  
**Score:** /30  
**Percentage:** /100

### Question 1a

Fig. 1 shows two processes (A and B) by which ATP can be synthesised.

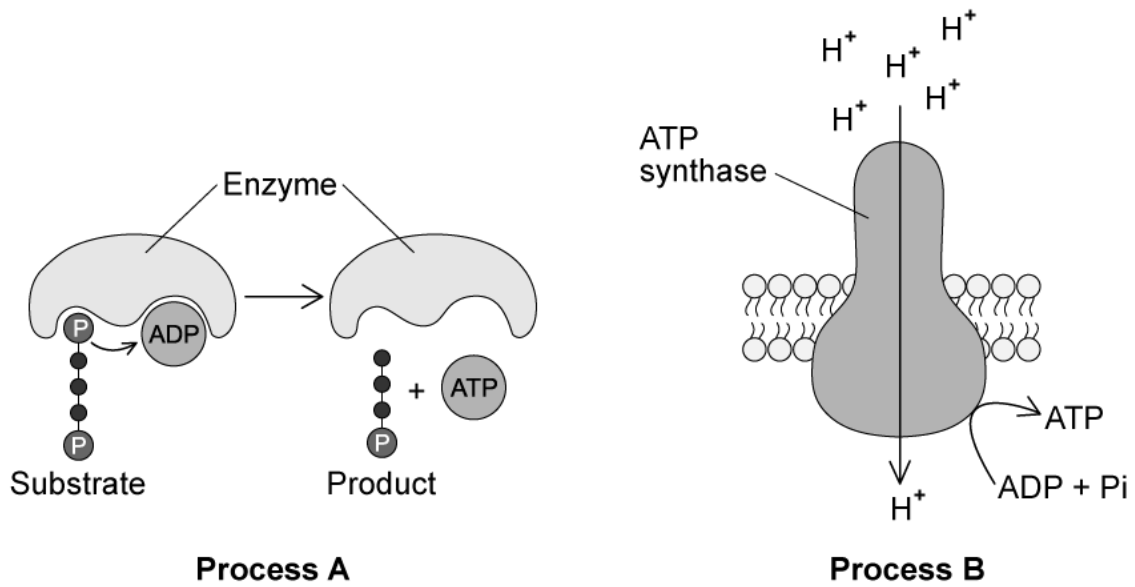


Fig. 1

Identify processes A and B.

[1 mark]

### Question 1b

Contrast process A and B in Fig. 1 with regards to ATP synthesis.

[3 marks]

### Question 1c

Only process A in Fig. 1 can occur in anaerobic conditions.

Explain why process B in Fig. 1 cannot occur without the presence of oxygen.

[3 marks]

**Question 1d**

The average human synthesises more than 50 kg of ATP each day.

Suggest the reasons for synthesising such a large mass of ATP.

[2 marks]

**Question 2a**

Table 1 shows the amount of energy released per gram of different respiratory substrates.

**Table 1**

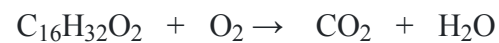
Respiratory substrate	Energy value / $\text{kJ g}^{-1}$
Carbohydrate	15.8
Lipid	39.4
Protein	17.0

With reference to Table 1, explain the difference in the amount of energy released by the different respiratory substrates.

[6 marks]

### Question 2b

Palmitic acid is a saturated fatty acid found in palm oil, cheese and milk. It can be broken down during aerobic respiration, as represented by the following **partially-completed** equation:



Calculate the respiratory quotient (RQ) of palmitic acid.

Show your working.

**[3 marks]**

### Question 2c

The RQ value for glucose is 1.0

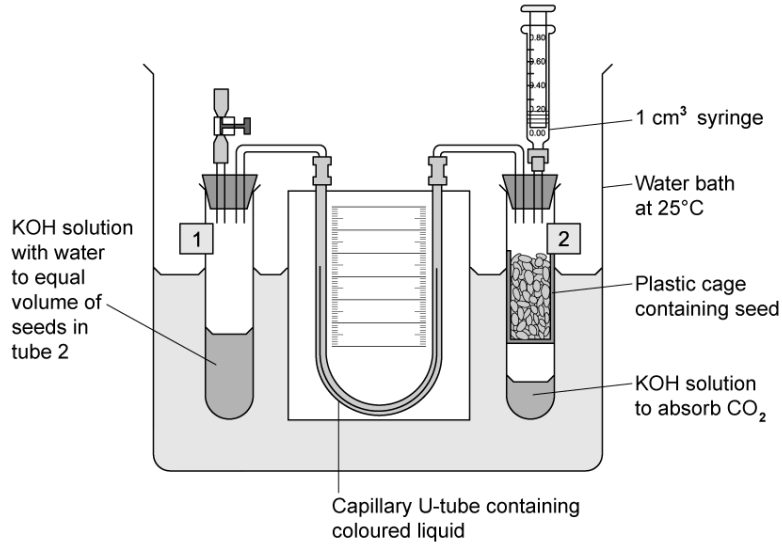
Discuss the difference in the RQ values of glucose and palmitic acid.

**[2 marks]**

**Question 3a**

Fig. 1 shows a respirometer that was set up to measure the rate of respiration of germinating mung bean seeds.

It consisted of two linked tubes, 1 and 2, held in a temperature-controlled water bath.



**Fig. 1**

The capillary tubes in the U-tube containing coloured liquid have an internal diameter of 1mm.

(i)  
Explain why the volumes of potassium hydroxide (KOH) are different in tubes 1 and 2.

[2]

(ii)  
Suggest an experimental modification to allow the volumes of potassium hydroxide (KOH) to be the same in tubes 1 and 2.

[1]

**[3 marks]**

### Question 3b

The experimenters used 10g of active mung bean seeds and recorded the seeds' respiration over a 20 minute period.

They calculated a rate of movement of the liquid in the U-tube of  $4\text{mm}^3 \text{hr}^{-1} \text{g}^{-1}$ .

Calculate how far, to the nearest mm, the liquid in the U-tube moved in the 20 minute period of their investigation.

[3 marks]

### Question 3c

Following the investigation, the scientists reset the respirometer and ran the experiment again, this time with distilled water in place of KOH in both tubes 1 and 2.

They recorded a slight upward movement of the liquid in the U-tube manometer on the side of tube 2, this time at a rate of  $0.72 \text{mm}^3 \text{hr}^{-1} \text{g}^{-1}$ .

Calculate the respiratory quotient (RQ) of the respiring mung bean seeds in this investigation.

[2 marks]

### Question 3d

Suggest, with a reason, what the value of the RQ that you calculated in part (c) indicates about the main food group(s) that the mung bean seeds were respiring at the time of this investigation.

[2 marks]