



GCE Biology

S21-A400U10-1

Assessment Resource 1

Energy for Life Resource A

Answer all questions.

1. ATP is regarded as a universal energy currency as it is used in all organisms for cellular processes.

(a) Draw a simple, fully labelled diagram of ATP. [2]

- (b) The energy released when glucose is broken down in the presence of oxygen is coupled with an endergonic reaction in order to produce ATP. However, only a fraction of the released energy goes into the high-energy bonds of ATP; energy is lost as heat.

Using the following equation, the efficiency of ATP production can be determined by comparing the energy in ATP synthesised with the total energy released in the respiration of one glucose molecule:

$$\text{efficiency} = \frac{N \times E_{\text{ATP}}}{E_{\text{react}}} \times 100$$

N number of ATP molecules synthesised

E_{ATP} energy in terminal ATP bond

E_{react} total energy released in the respiration of one glucose molecule

Under standard conditions

$$E_{\text{ATP}} = -7.3 \text{ kcal mol}^{-1}$$

$$E_{\text{react}} = -686 \text{ kcal mol}^{-1}$$

Assume that 38 molecules of ATP are synthesised.

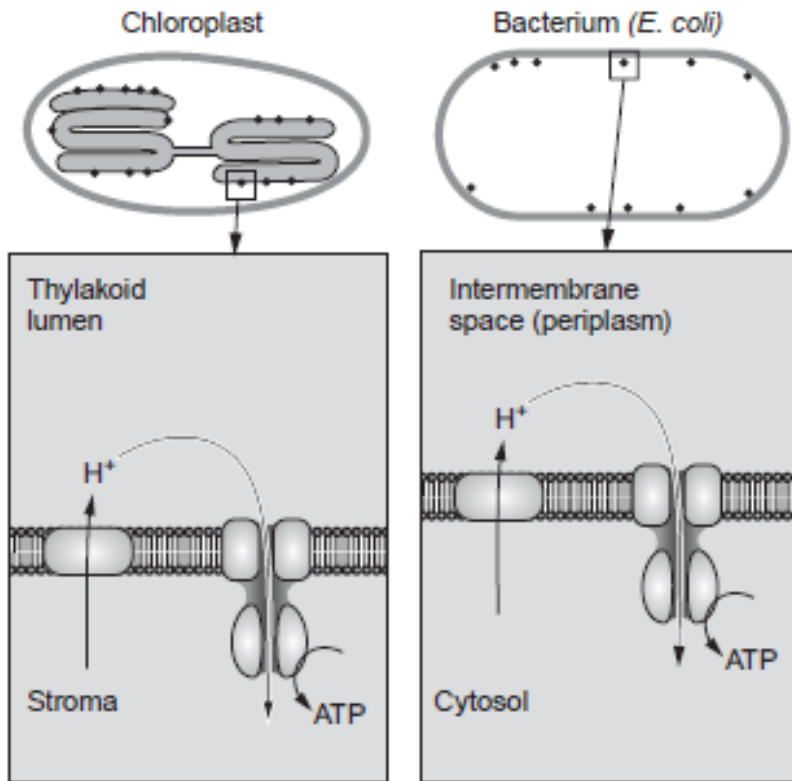
- (i) Calculate the efficiency of ATP production from glucose for the figures above. Give your answer to one decimal place. [2]

Efficiency = %

- (ii) The efficiency of an electric motor or petrol engine is between 10% and 20%. Use the result from your calculation to make a quantitative conclusion about the efficiency of ATP synthesis from glucose compared with that of an electric or petrol engine. [1]

.....

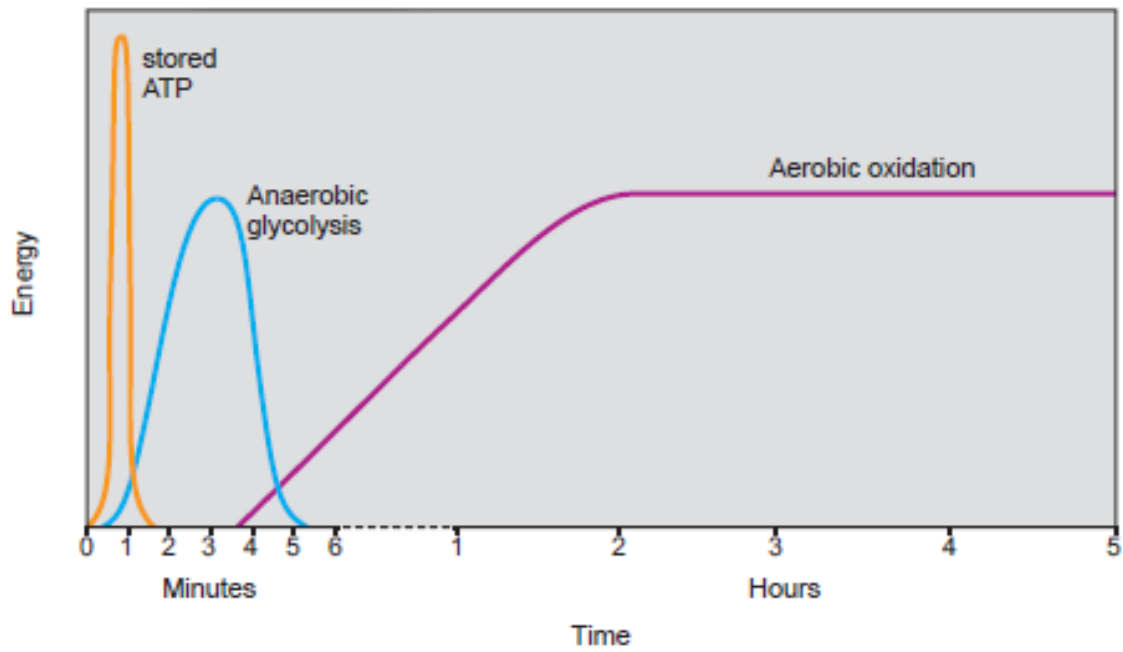
- (c) A simple diagram showing ATP synthesis in a chloroplast and a Gram negative bacterium is shown below.



State four similarities between the process of ATP synthesis in chloroplasts and the bacterium. [4]

.....

(d) The diagram below shows the use of ATP from three sources over a 5 hour period, whilst undertaking exercise.



State the conclusions you could draw from this data.

[3]

.....

.....

.....

.....

.....

.....

- 2 Natural, species rich, seasonally-flooded grasslands are one of the rarest forms of flower-rich meadows with rare plants such as orchids. These rare plants survive on flooded meadows where levels of nitrates are low.

Many such meadows have been lost through ploughing and the application of fertilisers to increase yields of hay.

Many species-rich meadows in floodplains next to streams and rivers function as seasonal washlands, by temporarily storing flood water during periods of high water flow.

- (a) Explain how the low levels of nitrates are brought about in these meadows. [2]

.....

.....

.....

.....

- (b) Explain fully how the change in agricultural practices has led to the loss of this type of meadow. [3]

.....

.....

.....

.....

.....

- (c) Given that one effect of global warming appears to be more flooding in the UK, discuss why the government is encouraging landowners to preserve and re-instate such meadows in certain areas by compensating them for the loss of productive farm land. [4]

.....

.....

.....

.....

.....

.....

- (d) Two species of plantain, greater plantain (*Plantago major*) and ribwort plantain (*Plantago lanceolata*) are very common in grassy areas in Britain. Both plantain species are frequently found on trampled ground.



Greater plantain (*Plantago major*)



Ribwort plantain (*Plantago lanceolata*)

The table shows some characteristics of these two species.

Feature	Greater plantain	Ribwort plantain
Main growth form	rosette	rosette
Drought tolerance	tolerant	not tolerant
Resistance to physical damage	very resistant	moderately resistant
Ability to vary growth form under different conditions	can vary	varies readily
Seed germination	best near soil surface on open ground	best on lightly compacted soil either in open ground or amongst vegetation
Overwintering	as small rosettes or underground	as small rosettes

- (i) Describe the technique you would use to carry out an assessment of the abundance of these two species across a moderately trampled footpath. [3]

.....

.....

.....

.....

.....

.....

- (ii) Using the information in the table, predict which species would be found mainly in the centre of the trampled path and which species is found mainly at the edges, giving reasons for your choice. [4]

.....

.....

.....

.....

.....

.....

.....

.....

(e) Trophic level transfer efficiency measures the energy that is transferred between trophic levels in ecosystems.
A food chain can usually sustain no more than six energy transfers.
Net Production Efficiency (NPE) measures how efficiently each trophic level uses and incorporates the energy from its food into biomass available to the next trophic level.

(i) Why does a food chain usually sustain no more than six energy transfers? Explain why it would be more energy efficient to produce food in the form of corn, soybeans, and other crops rather than as meat and other animal products. [3]

.....

.....

.....

.....

.....

.....

(ii) Explain why most warm-blooded organisms have to eat more often than cold-blooded organisms to get the energy they need for survival. [2]

.....

.....

.....

.....