

Specimen answer 1

June 14 BIOL5 10b

10 Write an essay on one of the following topics.

EITHER

- 10 (a) How cells and organisms carry out exchanges with their external environment to maintain their internal environment.

[25 marks]

OR

- 10 (b) How energy is transferred within and between organisms.

[25 marks]

If you want to make a plan write it here.

10. b)	<u>BIOL 1</u>	<u>BIOL 2</u>	<u>Themes</u>
	cardiac cycle ↳ contraction	mitosis - G ₁ /S phase	Light electrical chemical
	<u>BIOL 4</u>	<u>BIOL 5</u>	
light	photosynthesis	Thermoregulation	
electrical	respiration	ATP in muscle	
	trophic levels	contraction	
		eyes, rods and cones	
		impulses	



Energy can take many different forms, and is an essential component in the maintenance and continuity of life.

One form that energy can take is light energy. In this example we will consider the process of photosynthesis, which relies heavily upon light energy in order to work. Without photosynthesis, hexose sugars such as glucose, are not produced and so growth is not promoted. Thus the plant dies. In photosynthesis, light energy in the form of photons of light hit the chlorophyll molecules, cause the chlorophyll to become excited. They then emit high energy electrons, which pass down a chain of electron carriers. The energy generated from this transfer is used to combine ADP and P_i to form ATP, a molecule that when split also releases energy.

Electron transport chains also occur in respiration. Again energy transferred between carriers is used to combine ADP and P_i to form ATP. However, the energy is also used to pump protons from the matrix of the mitochondria and into the inter-

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membrane space. Here, proton concentration builds up, establishing a proton gradient across the mitochondrial membrane. This brings me on to the next another form of energy that energy can take - electrical ~~chemical~~ energy. As a result of the established proton gradient, the protons can diffuse back into the matrix through stacked particles in the membrane - the ATP synthase enzyme. As they diffuse down, they generate electrical potential energy, which is ~~exactly~~ enough to also combine ADP and P_i to form ATP.

ATP is an example of an energy source. It is a molecule that many metabolic processes rely on in order to occur. ATP can be hydrolysed to release energy in a single step reaction. ATP features in the mechanism of muscle contraction. When myosin heads are bound to the actin filaments during contraction, ATP molecules bind to the myosin heads. The energy released from the hydrolysis of ATP causes the head to detach from actin. The head returns to its original position, and then

reconnects to axon but further along. This may not seem significant if we consider an individual unit, but on a large scale where this action is produced simultaneously, it enables the muscle to contract with great force. One example being the heart. ~~Muscles are important. However in order~~ The heart uses impulses, originating from the sino atrial node (SAN), to cause atrial contraction. In turn, this stimulates the atrioventricular node (AVN) to produce an impulse that travels to the ventricular wall via the bundle of His and Purkinje fibres - leading to ventricular contraction. However, in order for the stimulation and contraction to occur they require impulses. Impulses are in itself electrical energy, passing through nerves at such a pace. The generation of ^{this} electrical energy requires the use of ions and chemical gradients, ions carry charges that enable them to change the membrane potential of axons. The electrically ^{positive} charge of Na^+ ions when they diffuse into the axon via sodium channels causes depolarisation. When the threshold

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percentage of energy transfer approximately 2%. This is as a result of factors such as that not all the food is digestible; some of the energy gained is used in respiration and lost as heat; some energy is lost in the form of egestion of faeces. However bacteria, such as saprobionic bacteria, can fix this energy to form useful products.

If we consider a generic aspect and how energy is involved, we find that mitosis plays an example. Most of the cells are in the interphase stage for most of time, and ²⁰ during the G₁ phase the rate of respiration by the cell has increased in order to synthesise and replicate organelles.

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Senior examiner annotations				
#	Item	Page	Mark/symbol	Annotation
1	10	2	0	Little introduction, no penalty.
2	10	2	0	Good comment.
3	10	2	0	Ignore energy generated.
4	10	2	0	Shows movement and use of energy, addresses title.
5	10	3	0	References to energy change here.
6	10	3	0	A - Not quite enough on ATP.
7	10	3	0	M starts.
8	10	4	0	M - Good theory but not enough energy change.
9	10	4	0	Not related to energy, therefore irrelevant.
10	10	4	0	N - Nerves not linked to theme, needs link to ATP.
11	10	5	0	Ecology, only basic spec knowledge.
12	10	5	0	Ec - Some element of why energy not transferred. Needs ref to food as substrate for respiration.
13	10	6	0	Ignore short concluding paragraph.
14	10	6	20	A-level content in number of topics (4/5) and links to theme. One irrelevant topic. Relational - awarded 20 marks.