Specimen answer 9

June 14 BIOL5 10a

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.

~~Energy transfer – Nitrogen cycle~~

Exchanges with environment Transpiration → [illegible]

Respiration

[illegible]

Breakdown of food

Cellular exchange – diffusion

– Active transport

Homeostasis

Plan

10a) How cells and organisms deal with changes in their external environment to maintain their internal environment.

It is important that organisms regulate their internal environment in order to provide optimum conditions for internal reactions. The maintenance of a constant internal environment is known as homeostasis. Regulating internal conditions means organisms are [illegible] survival in it means that the organism can grow and reproduce at the optimum level.

One way in which plants maintain their internal environment is through transpiration. Water is absorbed through the roots of the plant via the root hair cells and travels up the xylem via a series of hydrogen bonds. Water evaporates from the leaves and as the water molecules inside the xylem are bonded together in a chain, the evaporation causes more water molecules to be dragged up the plant to replace those lost from the leaves. Transpiration ensures that water is available for photosynthesis and for maintaining the turgidity of cells. By regulating the amount of water that evaporates from the leaves with the amount of water that is absorbed through the roots it ensures that the plant does not become dehydrated.

This brings me on to cell turgidity. It is important that plant cells remain turgid (or 'firm') in order to maintain the structure of the plant. The water potential inside

the cells must remain steady. If the water potential falls, the cell may shrink. In this case water would enter the cell via osmosis. If the water potential inside the cells were too high it could burst. In this case water would leave the cell via osmosis.

Another way in which plants interact with their external environment is through photosynthesis. When light hits a plant leaf it is absorbed by a chlorophyll molecule. ~~Two e~~ A pair of electrons within this molecule become excited and are raised to a higher energy level. They enter the electron transport chain, where each electron carrier is at a slightly lower energy level than the previous one, so energy is released as the electrons travel across the chain. This ~~electron~~ energy combines ADP and Pi to form ATP. The final electron carrier is NADP. The electrons along with hydrogen from the splitting of water (hydrolysis) reduce ~~NADH~~ to NAD to NADH. ~~This is then used to reduce~~ This is then used to reduce GP to TP in the next stage of photosynthesis, the light independent reaction, which requires CO_2. Photosynthesis is important because it produces glucose which is an energy source for the plant. It involves gaseous exchange with the environment as CO_2 is taken in and O_2 is given out as a waste product of the light independent reaction.

Animals gain energy through the breakdown

of food into glucose which is then used for respiration. The
Food is broken down by ~~enzymes first by~~ enzymes -
first by amylase in the saliva and then by digestive enzymes in
the gut. Glucose is absorbed into the blood through the lining
of the small intestine by diffusion and via co-transport
proteins. Glucose can then be used as immediate energy
source for respiration or converted into glycogen via
glycogenesis. Glycogen is a long-term energy store
in the liver.

One aspect of an animal's internal environment that
needs to be maintained is temperature. ~~If temperature rises~~
At high temperatures, provides kinetic energy for enzymes,
increasing the frequency of their collisions with substrates and
therefore increasing the number of enzyme-substrate complexes
that are formed. Thus metabolic reactions happen faster.
However, if the temperature is too high enzymes become
denatured as once the bonds that give them their tertiary
structure are broken and their active sites change shape. ~~Temp~~
Therefore an organism must detect changes in the
internal environment of temperature. If too high it is
detected by thermoreceptors in the hypothalamus, which
measures blood temperature. Signals are sent to effectors in
the skin to cause vasodilation, which increases heat loss
to increase heat loss through radiation, and sweating.
Sweating involves the loss of water to the external

environment. The water evaporates from the stomata leaving
sodium chloride behind.

Red blood cells exchange oxygen with the
external environment. The pigment haemoglobin combines
with O_2 in the blood to form oxyhaemoglobin. The 0
is carried around the body by the red blood cells.
Every blood cell has the oxygen released for
cellular respiration.

Respiration is probably the most important
example of exchange between organisms and the environment,
because it provides the energy needed for growth, repair,
internal reactions and cell division. Glucose is converted
into pyruvate during glycolysis which forms a net
product of 2 ATP molecules. Pyruvate then goes 0
through the Krebs cycle ~~where it is converted~~
~~to acetyl coA~~ in the Krebs cycle NAD and
FAD are reduced and finally ATP is produced. The
NADH and FADH continue to the electron transport
chain where the hydrogen that they carry provides
electrons and protons that travel from one electron
carrier to the next. Energy is released from each
electron carrier and is then used from the
last. This is the chemiosmosis process 14

Senior examiner annotations				
#	**Item**	**Page**	**Mark/ symbol**	**Annotation**
1	10	1	0	Plan noted.
2	10	2	0	H - Homeostasis noted but no detail.
3	10	2	0	W - Passage of water through a plant noted and transpiration idea.
4	10	3	0	C – Cells noted, idea of turgidity.
5	10	3	0	Respiration irrelevant.
6	10	3	0	G – Gas exchange noted but not enough detail.
7	10	4	0	D – Digestion noted and idea of glucose release from food to be absorbed.
8	10	4	0	T – Temperature control noted and detail on temperature regulation. Section above about enzymes not creditworthy, but not regarded as irrelevant as it is linked to the following passage.
9	10	5	0	C- Cells noted, but no detail given (could also be credited under Tf – tissue fluid).
10	10	5	0	Respiration irrelevant.
11	10	5	14	A-level detail in some topics but not really addressing the theme of the essay, or interrelated. One irrelevant topic area but no significant errors. Multistructural - awarded 14 marks.