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Phone: +442081445350

www.chemistryonlinetuition.com

Email: asherrana@chemistryonlinetuition.com

BIOLOGY

ENERGY TRANSFERS IN & BETWEEN ORGANISMS

Level & Board	AQA (A-LEVEL)
TOPIC:	PHOTOSYNTHESIS
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	5
TOTAL MARKS	38

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Photosynthesis - 1

1.

(a) NADP, ADP, Pi and water

(b) This process is called photoionization. Water acts as an electron donor to replace the missing electrons in the chlorophyll molecule. This leads to water being oxidized, which means it loses electrons. Water is split into oxygen, two H⁺ ions, and two electrons through this process (photolysis).

OR

Light excites electrons in chlorophyll

Electrons are lost from chlorophyll

(c) Because pen ink will undergo the chromatography process and mess up your results. Pencil contains only graphite, while pen ink contains a variety of compounds, which would become separated by the process. A pens ink may contain dye molecules that can interfere with the visible interpretation of the chromatogram.

OR

Ink and leaf pigments would mix

(d)

- Level of solvent below origin line
- Remove before solvent front reaches the top

(e) Absorb different/more wavelengths of light

OR

The different pigments in the plants allows them to absorb the light of different wavelengths, this helps them to capture more light energy for photosynthesis. The different pigments impart different colors to the leaves, which promote sunlight absorption in accordance with the color of the leaf.

2.

(a) A decrease in the activity of the enzyme rubisco would limit the rate of photosynthesis.

OR

Less ATP and Less reduce NADP

(b)

Less CO₂ reacts with RuBP

Less gp

(c) Rubisco, or Ribulose-1,5-bisphosphate carboxylase/oxygenase, is an enzyme that plays a significant role in the process of photosynthesis. The enzyme Rubisco is found specifically in the chloroplasts of plant cells.

OR

Stroma of the chloroplast

(d)

- Rubisco activity increases with temperature
- OR
- Rubisco optimum temperature is above (rubisco activase);
 - Rubisco activase activity decreases at high temperatures (allow any temperature above 25 °C.)
- OR
- Rubisco activase optimum (allow in range) 25 to 30 °C.
 - Results/graphs suggest activase cannot/does not affect activity of rubisco
 - Results are only for cotton
 - Results are for isolated enzymes
 - No stats test

3.

(a) The importance of having the same water potential in the solution and the chloroplasts lies in preventing the movement of water either into or out of the chloroplasts by osmosis.

OR

Osmosis does not occur

Chloroplast/organelle does not burst.

(b)

To show light does not affect DCPIP

To show chloroplasts are required

(c)

Reduction of DCPIP by electrons

From chlorophyll/light dependent reaction

(d)

Provides a standard / reference point

OR

Can compare different chemicals/weed- killers

OR

Can compare different concentrations of chemicals/weed-killers

4.

(a)

Oxygen is produced in the light-independent reaction

The faster it's produced, the faster the light-dependent reaction occurs

OR

The scientists measured the rate of oxygen production to gauge the rate of photosynthesis in the plants. The quantity of oxygen produced via photosynthesis serves as a direct indicator of the photosynthetic rate.

(b) Low light= 60

High light= 200

$200 - 60 = 140$

4x15 mins in an hour

$140/4$

= 35 μmol Oxygen per mg chlorophyll.

(c) At all light intensities, chloroplasts from mutant plants:

Have faster production of ATP and reduced NADP

So have faster / more light-independent reaction

So produce more sugars that can be used in respiration

So have more energy for growth

Have faster / more synthesis of new organic materials.

5.

(a)

Stirrer distributes heat insulation

water = high heat capacity

(b)

100cm

$3/1000 = 0.1\text{kg}$

$0.1 \times 4.18 \times 15.7$

$= 6.56/2$

$= 3.28\text{KJ/g}$

(c)

Transmission

Reflected

Misses chlorophyll / chloroplasts

Wrong wavelength

(d) The light-dependent reactions use light energy to make two molecules needed for the next stage of photosynthesis: the energy storage molecule ATP and the reduced electron carrier NADPH.



DR. ASHAR RANA
M.B.B.S / MS. CHEMISTRY



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— TUITION —

Phone: +442081445350
www.chemistryonlinetuition.com
Email: asherrana@chemistryonlinetuition.com

- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Math's and Biology Tutor

CONTACT INFORMATION FOR CHEMISTRY ONLINE TUITION

- UK Contact: 02081445350
- International Phone/WhatsApp: 00442081445350
- Website: www.chemistryonlinetuition.com
- Email: asherrana@chemistryonlinetuition.com

Address: 210-Old Brompton Road, London SW5 OBS, UK