K3D Respiration and Photosynthesis: Exam Drill

AQA AQA KS3 Biology · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which two raw materials does a green leaf need for photosynthesis? Choose two.

- ☐ A) Carbon dioxide
- ☐ B) Nitrogen gas
- ☐ C) Water
- ☐ D) Oxygen

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2 Write down the word equation for aerobic respiration in humans.

(a) Word equation for aerobic respiration. **(3)**

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3 A student tests a leaf for starch to show photosynthesis has happened. She boils the leaf in water, then in ethanol to remove chlorophyll, and finally adds iodine solution which turns blue-black where starch is present.

(a) Why is the leaf boiled in water at the start? **(1)**

(b) Why is ethanol used after boiling in water? **(1)**

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4 A gardener measures the number of bubbles of oxygen produced by an aquatic plant in different light intensities over 5 minutes. Data: Light intensity 10 units -> 8 bubbles; 20 units -> 16 bubbles; 40 units -> 30 bubbles; 80 units -> 34 bubbles.

(a) Calculate the rate of oxygen production (bubbles per minute) at light intensity 40 units. **(2)**

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(b) Describe what happens to the rate of oxygen production between light intensity 40 and 80 units and give a simple biological reason. **(2)**

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5 Name the organelle in plant cells where photosynthesis happens.

(1)

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6 Write down the word equation for photosynthesis, including the products.

(3)

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7 Name the small openings on the underside of a leaf that allow carbon dioxide in and oxygen out.

(1)

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8 Which of these is a product of anaerobic respiration in human muscle cells during vigorous exercise?

- ☐ A) Carbon dioxide and water
- ☐ B) Lactic acid
- ☐ C) Ethanol and carbon dioxide
- ☐ D) Oxygen

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9 Write the word equation for anaerobic respiration in yeast cells (fermentation), then explain one everyday use of this process.

(a) Word equation for anaerobic respiration in yeast. **(2)**

(b) Give one everyday use of this process. **(1)**

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10 Give two ways aerobic respiration differs from anaerobic respiration in animal cells.

(a) Difference in oxygen requirement. **(1)**

(b) Difference in energy released. **(1)**

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11 A student places pondweed in two test tubes of hydrogencarbonate indicator solution, which is orange-red at normal air CO_2 levels, turns purple when CO_2 falls, and turns yellow when CO_2 rises. One tube is left in bright light, the other in the dark, for two hours.

(a) What colour will the indicator turn in the tube left in bright light, and why? **(2)**

(b) What colour will the indicator turn in the tube left in the dark, and why? **(2)**

(c) Suggest one variable that should be kept the same between the two tubes to make this a fair comparison. **(2)**

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12 A greenhouse gardener increases the carbon dioxide concentration in a greenhouse from 0.04% to 0.1% while keeping light intensity and temperature constant. The rate of photosynthesis of the plants increases.

(a) Explain why increasing the carbon dioxide concentration increased the rate of photosynthesis. **(2)**

(b) Suggest what would happen to the rate of photosynthesis if the carbon dioxide concentration were increased further and further, and explain why. **(2)**

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13 A pondweed produces 45 cm^3 of oxygen gas in 15 minutes during photosynthesis. Calculate the mean rate of oxygen production in cm^3 per minute.

(2)

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14 Which organelle is the main site of aerobic respiration, releasing energy from glucose?

- ☐ A) Chloroplast
- ☐ B) Nucleus
- ☐ C) Mitochondria
- ☐ D) Ribosome

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15 Explain why plants need to respire even though they can also photosynthesise.

(3)

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16 A student investigates the effect of light intensity on the rate of photosynthesis of pondweed by counting bubbles of oxygen released per minute at different distances from a lamp.

(a) Identify one variable the student should keep the same. **(1)**

(b) Explain why this variable must be controlled. **(2)**

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17 Give one reason why counting bubbles is not always a reliable way to measure the rate of photosynthesis, and suggest a better method.

(2)

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18 Which of these is NOT usually a limiting factor for the rate of photosynthesis?

- ☐ A) Light intensity
- ☐ B) Carbon dioxide concentration
- ☐ C) Temperature
- ☐ D) Oxygen concentration

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Mark scheme · K3D Respiration and Photosynthesis: Exam Drill

Question 1

- **B1** carbon dioxide and water cao (A and C)
- Answer: **Carbon dioxide and water**

Question 2

- (a) **M1** glucose + oxygen -> carbon dioxide + water + energy (all components present) cao
- (a) **A1** energy included as a product or implied in words (cao) ft
- (a) **A1** order of reactants and products acceptable if components are present (cao)
- (a) Answer: **Glucose + oxygen -> carbon dioxide + water + energy**

Question 3

- (a) **B1** to stop enzyme activity and break down cell membranes so iodine can reach starch (oe)
- (a) Answer: **To stop enzyme activity and break down cell membranes so the iodine can reach any starch**
- (b) **B1** to remove chlorophyll so colour change from iodine can be seen clearly
- (b) Answer: **To remove chlorophyll so the iodine colour change can be seen clearly**

Question 4

- (a) **M1** calculate 30 bubbles / 5 minutes
- (a) **A1** 6 bubbles per minute cao
- (a) Answer: **6 bubbles per minute**
- (b) **M1** states rate increases only slightly from 6 to 6.8 bubbles per minute (34/5 = 6.8) or says it levels off
- (b) **A1** gives reason such as another factor becoming limiting, e.g. CO2 or temperature, so photosynthesis levels off
- (b) Answer: **Rate increases only slightly from 6 to 6.8 bubbles per minute; photosynthesis is levelling off because another factor such as CO2 or temperature is limiting**

Question 5

- **B1** chloroplasts cao
- Answer: **Chloroplasts**

Question 6

- **M1** reactants correct: carbon dioxide + water cao
- **A1** arrow labelled to show light (energy) is needed, oe
- **A1** products correct: glucose + oxygen cao
- Answer: **Carbon dioxide + water --(light energy)--> glucose + oxygen**

Question 7

- **B1** stomata cao
- Answer: **Stomata**

Question 8

- **B1** lactic acid cao (B)
- Answer: **Lactic acid**

Question 9

- (a) **M1** glucose -> ethanol + carbon dioxide cao
- (a) **A1** + energy included, oe
- (a) Answer: **Glucose -> ethanol + carbon dioxide + energy**
- (b) **B1** brewing/making alcoholic drinks or bread-making (carbon dioxide makes dough rise), oe
- (b) Answer: **Bread-making - the carbon dioxide produced makes the dough rise**

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Question 10

- (a) **B1** aerobic needs oxygen; anaerobic does not, oe
- (a) Answer: **Aerobic respiration requires oxygen; anaerobic respiration does not**
- (b) **B1** aerobic releases much more energy per glucose molecule than anaerobic, oe
- (b) Answer: **Aerobic respiration releases much more energy from each glucose molecule than anaerobic respiration**

Question 11

- (a) **M1** indicator turns purple
- (a) **A1** because photosynthesis removes more CO_2 than respiration produces, lowering the CO_2 concentration, oe
- (a) Answer: **Purple - photosynthesis removes more carbon dioxide than respiration produces, so the CO_2 concentration falls**
- (b) **M1** indicator turns yellow
- (b) **A1** because only respiration occurs in the dark, releasing CO_2 and raising the CO_2 concentration, oe
- (b) Answer: **Yellow - only respiration occurs in the dark, releasing carbon dioxide, so the CO_2 concentration rises**
- (c) **M1** e.g. temperature, volume of indicator solution, size/mass of pondweed, distance from any light source (for the lit tube)
- (c) **A1** reason: this variable also affects the rate of photosynthesis/respiration, so it must be controlled so any colour difference is due only to light, oe
- (c) Answer: **Keep the temperature of both tubes the same, because temperature affects the rate of both photosynthesis and respiration, so any colour difference should be caused only by the presence or absence of light**

Question 12

- (a) **M1** carbon dioxide was the limiting factor (in short supply, restricting the rate)
- (a) **A1** more CO_2 available means more can be used as a raw material for photosynthesis, so the rate increases, oe
- (a) Answer: **Carbon dioxide was limiting the rate of photosynthesis; increasing its concentration provided more of this raw material, so more photosynthesis could occur**
- (b) **M1** the rate would eventually level off (stop increasing)
- (b) **A1** because another factor, such as light intensity or temperature, would then become limiting, oe
- (b) Answer: **The rate would level off, because another factor such as light intensity or temperature would then become the limiting factor**

Question 13

- **M1** 45 / 15
- **A1** 3 cm^3 per minute cao
- Answer: **3 cm^3 per minute**

Question 14

- **B1** mitochondria cao (C)
- Answer: **Mitochondria**

Question 15

- **M1** plants need energy for life processes such as growth and active transport at all times, oe
- **M1** photosynthesis can only happen when light is available, whereas respiration happens continuously in all living cells, oe
- **A1** conclusion linking the two points: respiration is needed constantly to supply energy, day and night, oe
- Answer: **Plants need energy for life processes such as growth and active transport at all times. Photosynthesis only happens when light is available, but respiration happens continuously in every living cell, so plants must respire constantly to supply this energy, day and night.**

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Question 16

- (a) **B1** e.g. water temperature, CO_2 concentration (amount of sodium hydrogencarbonate), length/mass of pondweed
- (a) Answer: **The temperature of the water**
- (b) **M1** this variable also affects the rate of photosynthesis
- (b) **A1** so it must be kept constant so that any change in bubble rate is caused only by light intensity, oe
- (b) Answer: **Temperature also affects the rate of photosynthesis, so it must be kept the same so that any change in the rate of bubbling is caused only by the change in light intensity**

Question 17

- **M1** bubbles vary in size, so counting them does not accurately measure the volume of gas produced, oe
- **A1** better method: collect the gas in a syringe/inverted measuring cylinder and measure its volume directly
- Answer: **Bubbles can vary in size, so counting them is not an accurate measure of the volume of oxygen produced. A more reliable method is to collect the gas in a gas syringe or inverted measuring cylinder and measure its volume directly.**

Question 18

- **B1** oxygen concentration cao (D)
- Answer: **Oxygen concentration**

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