GCSE Physics Test Energy

1. Name the following forms of energy: (1 mark each)

   a) energy of a moving object

   kinetic energy

   b) energy of an object raised above the ground

   gravitational potential energy

   c) energy being transferred from a hot place to a cooler place

   heat energy (thermal energy)

   d) energy of a stretched spring.

   elastic (strain) potential energy

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2. An electric lamp is supplied with 3600 J of energy each minute. It transforms this energy to light and heat energy. It produces 3 J of light energy each second.

   a) Calculate the energy supplied to the lamp each second. (1 mark)

   60 J

   b) Calculate the amount of heat energy produced by the lamp each second. (1 mark)

   57 J

   c) Name the principle you have used in calculating your answer to part **b**. (1 mark)

   principle of conservation of energy

d) Calculate the efficiency of the lamp. (2 marks)

5%

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3. A boy lifts a stone of mass 0.4 kg from the ground and holds it above his head at a height of 2.0 m above the ground. He then throws it so that it leaves his hand with a speed of 6 m/s.

a) Calculate the stone's gravitational potential energy when it is held above the boy's head. (2 marks)

8.0 J

b) Calculate the stone's kinetic energy as it leaves the boy's hand. (2 marks)

7.2 J

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4. A kettle is 90% efficient. To boil the water 420 kJ is needed. Calculate how much electrical energy is used by the kettle. [2 marks]

420 ÷ 0.9 [1]

= 467 kJ [1]

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5. Electricity is generated in a number of ways. What name is given to each of the following?

a) electricity generated when the process of fission releases energy from uranium (1 mark)

nuclear power

b) electricity generated when water stored behind a dam turns a turbine (1 mark)

hydro-electric power (hydro-electricity)

c) the energy of sunlight converted directly into electrical energy (1 mark)

solar cell (photocell)

d) electricity generated when moving air turns a turbine. (1 mark)

wind energy

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6. A builder lifts five bricks. Each brick has a mass of 2.4 kg.

a) Calculate the weight of five bricks. (2 marks)

120 N

b) What force is needed to lift five bricks? (1 mark)

120 N

c) Th e builder lifts the bricks to the top of a building which is 6.0 m high. Calculate the work done in lifting the bricks. (2 marks)

720 J

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7. An electric motor has a power rating of 400 W.

a) How much energy does the motor transfer each second? (1 mark)

400 J

b) The motor provides a force of 50 N to lift a load. It raises a load of sand through a distance of 4.0 m. How much work is done on the sand? (2 marks)

200 J

c) Because the motor is inefficient, it can transfer just 100 J of energy to a load each second. Calculate the time taken by the motor to raise the sand. (1 mark)

2.0 s

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8. Describe how the walls of a building affect its rate of cooling and explain ways to reduce the energy transfer. [6 marks]

A thicker wall will mean the building will cool more slowly [1].

A lower thermal conductivity of the material the wall is built from will mean the building will cool more slowly [1] - for example brick has a lower thermal conductivity than metal, so it is better to build walls out of brick [1].

Energy transfer can also be reduced by using thermal insulation - a material with low thermal conductivity [1].

Cavity walls (two walls with a gap between them) will reduce heat transfer [1] as the cavity contains an insulator (air or another suitable insulator) [1].

Plan the key points that you should include in your answer.

Describe the features of the wall - thickness and thermal conductivity - and how they link to energy transfer. A way to reduce energy transfer is thermal insulation.

9. The UK produces most of its electricity from fossil fuels. Many people in the UK leave their televisions in 'stand by' mode when not in use, instead of switching them off. It is better for the environment if people switch off their televisions, instead of leaving them in 'stand by' mode. Explain why. [3 marks]

TVs in stand by use electricity [1].

Generating electricity (from fossil fuels) produces CO2 [1]. CO2 contributes to global warming [1].

Breaking the answer down into stages can help make sure that enough scientific points have been included.

10. The National Grid ensures that fossil fuel power stations in the UK only produce about 33% of the total electricity they could produce when operating at a maximum output. Suggest two reasons why. [2 marks]

Any two from:

conserves fuel reserves

spare capacity to compensate for unreliable renewable resources

provides spare capacity in case of power station emergency shutdown

to not make unnecessary environmental impact (pollution etc) [2]

Again, there are two marks for this question, so you must be able to give two points. You should also show that you have given reasons to explain why.

GCSE Quantitative Chemistry Test
Question1 (10 X 0.5 = 5 marks)

Calculations in chemistry

1 Which of these is the best definition of a mole?

- The relative atomic mass in grams of the substance
- The unit for the amount of substance
- The number of particles in the relative formula mass in grams of a substance

2 What is the definition of the Avogadro constant?

- The unit for the amount of substance
- 6.02×10^{23}
- The number of particles in one mole of a substance

3 What is the number of molecules in 23 g of NO_2? (M_r of NO_2 = 46)

- 1.204×10^{24}
- 6.02×10^{23}
- 3.01×10^{23}

4 What is the mass of 0.5 mol of HF gas? (M_r of HF = 20)

- 0.025 g
- 10 g
- 40 g

5 What is the amount of silver atoms in 216 g of silver, Ag? (A_r of Ag = 108)

- 2 mol
- 0.5 mol
- 4 mol

6 What amount of O_2 reacts with 4 mol of Al?

$4Al + 3O_2 \rightarrow 2Al_2O_3$

- 3 mol
- 2 mol
- 4 mol

7 What mass of Al reacts with 96 g of oxygen? M_r of O_2 = 32 and A_r of Al = 27.

$4Al + 3O_2 \rightarrow 2Al_2O_3$

- 54 g
- 108 g
- 27 g

8 What is a limiting reactant?

- The reactant that is present in the smallest mass
- The reactant that is left over at the end of the reaction
- The reactant that is all used up in a reaction

9 What is the concentration of a solution formed by dissolving 2 mol of nitric acid in 4 dm^3 of solution?

- 2 mol/dm^3
- 0.5 mol/dm^3
- 8 mol/dm^3

10 What is the volume of 250 cm^3 of solution in dm^3?

- 0.250 dm^3
- 0.025 dm^3
- 2.5 dm^3

Calculations in chemistry - Higher - AQA

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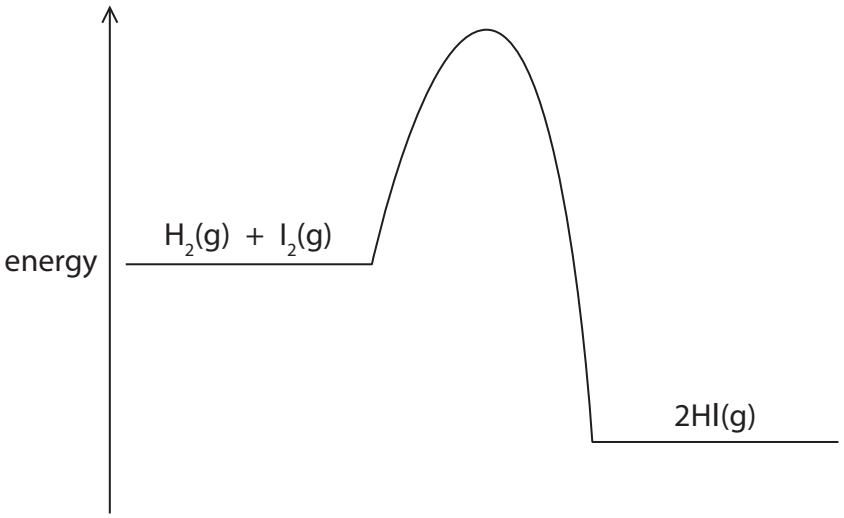
2 Hydrogen iodide can be manufactured from its elements using this reaction.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H = -9 \text{ kJ/mol}$$

A temperature of 500 °C, a pressure of 4 atm and a platinum catalyst are used in this manufacturing process.

(a) The diagram shows the reaction profile if a catalyst is not used.



(i) On the diagram, draw the reaction profile when a platinum catalyst is used.

(1)

(ii) Label the diagram to show the enthalpy change (ΔH) and the activation energy (E_{cat}) for the reaction with the catalyst.

(2)

(b) A manufacturer carries out this reaction using the same catalyst, a pressure of 4 atm, but a temperature of 400 °C.

(i) State the effect of this change in temperature on the rate of the reaction.

(1)

.....

.....

(ii) Explain the effect of this change on the yield of hydrogen iodide.

(2)

.....

.....

.....

.....

(c) The manufacturer then carries out this reaction using the same catalyst, a temperature of 500 °C, but a pressure of 2 atm.

(i) Suggest what effect this change in pressure would have on the rate of the reaction.

(1)

.....

.....

(ii) Explain the effect of this change on the yield of hydrogen iodide.

(2)

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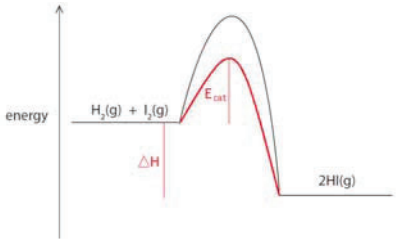
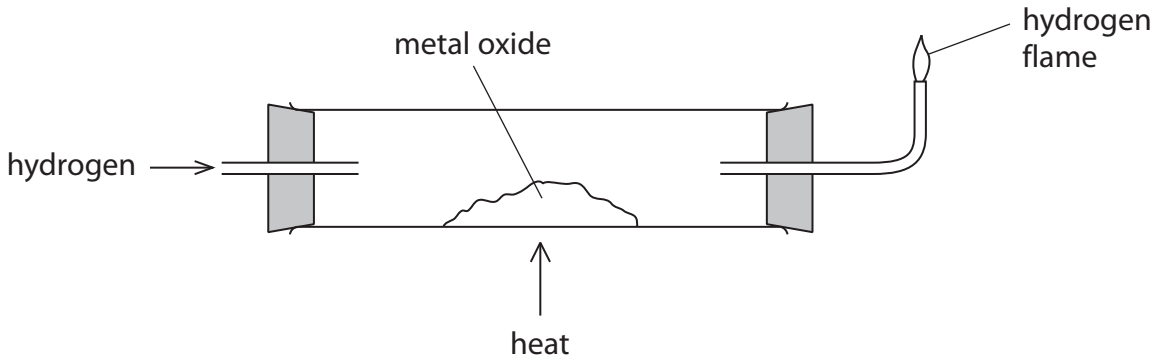
(Total for Question 8 = 9 marks)

Question number	Answer	Notes	Marks
2 (a) (i) (ii)	 	curve from reactant level to product level with peak below that of original (1) M1 for approximately vertical line/arrow between reactant level and product level labelled Δ*H*/enthalpy change/-9 kJ/mol M2 for approximately vertical line/arrow between reactant level and peak of candidate curve labelled E_{cat} /activation energy M1 and M2 CQ candidate curve	1 2
(b) (i)	rate decreases / OWTTE	Allow (reaction is) slower Allow reaction takes longer Ignore references to yield / position of equilibrium	1
(ii)	M1 (at lower temperature equilibrium position shifts to right so yield of hydrogen iodide) increases M2 because (forward) reaction is exothermic	 Ignore Δ*H* is negative Accept backward reaction is endothermic Ignore because reaction moves in exothermic direction Ignore references to Le Chatelier's principle e.g. decrease in temperature favours exothermic reaction M2 DEP M1	2

Question number	Answer	Notes	Marks
(c) (i)	(rate) decreases / OWTTE	Allow (reaction is) slower Allow reaction takes longer (to reach equilibrium) Ignore references to yield / position of equilibrium	1
(ii)	M1 (decrease in pressure has) no effect (on yield of hydrogen iodide) M2 because equal numbers of (gas) moles/molecules on both sides	Allow no change Ignore has no effect on other factors e.g. equilibrium (position) Ignore references to rate Allow (gas) particles for moles/molecules M2 DEP M1	2

(Total for Question 8 = 9 marks)

3 This apparatus can be used to investigate the reduction of metal oxides.



The mass of the metal oxide is measured before and after heating it in hydrogen.

The results can be used to determine the formula of the oxide.

(a) The hydrogen gas burns as it leaves the tube.

(i) What substance is formed when hydrogen burns in air?

(1)

.....

(ii) Why is it important to relight the flame if it goes out?

(1)

.....

.....

(b) These are the results for one experiment.

Mass of solid before heating = 4.2 g

Mass of solid after heating = 3.4 g

These results may not be sufficient to find the mass of metal for use in determining the formula of the metal oxide.

What further practical steps should be taken to confirm that an accurate value for the mass of metal has been obtained?

(2)

.....

.....

.....

.....

(c) In an experiment using a different metal oxide, a mass of 2.8 g of metal is obtained from 3.6 g of the metal oxide.

(i) Calculate the mass of oxygen in the sample of the metal oxide.

(1)

mass of oxygen = ... g

(ii) Calculate the amount, in moles, of oxygen atoms in the sample of the metal oxide.

(2)

amount of oxygen = ... mol

(iii) The formula of the metal oxide is MO, where M is the symbol of the metal.

Deduce the amount, in moles, of M in the sample of the metal oxide.

(1)

amount of M = ... mol

(iv) What is the relative atomic mass of M?

(2)

relative atomic mass of M = ...

(Total for Question 10 = 10 marks)

Question number			Answer	Notes	Marks
3	a	i	water	Accept steam	1
		ii	risk of explosion / to burn excess hydrogen safely	OWTTE Ignore hydrogen is flammable	1
	b		heat the solid again reweigh to check mass remains constant	Ignore burning Ignore repeat and find mean heat to constant mass = 2	1 1
	c	i	0.8		1
		ii	0.8 ÷ 16 0.05	CQ on (i) No ECF for division by 8 or 32 M2 subsumes M1	1 1
		iii	0.05 / answer to ii		1
		iv	2.8 ÷ 0.05 56	CQ on (iii) M2 subsumes M1 0/2 if any mass other than 2.8 used	1 1

(Total for Question 10 = 10 marks)

GCSE Biology test: Bioenergetics

Question1

Choose the correct answer: (10 X 0.5 = 5 marks)

1 What is the function of chlorophyll?
A to absorb light energy
B to attract sunlight
C to make a leaf look green
D to store starch grains

2 How does carbon dioxide get into a leaf?
A into the root hairs and up through the xylem
B into the stem and up through the phloem
C through the stomata
D through the upper epidermis

3 How does water get into a leaf?
A into the root hairs and up through the xylem
B into the stem and up through the phloem
C through the stomata
D through the upper epidermis

4 In which leaf tissue does most photosynthesis take place?
A upper epidermis
B palisade mesophyll
C spongy mesophyll
D lower epidermis

5 When testing a leaf for starch, why is the leaf placed in hot alcohol?
A to break down the starch
B to destroy the enzymes in the leaf
C to extract the chlorophyll from the leaf
D to kill the leaf cells

6 Why do plants need magnesium?
A to make chlorophyll
B to make proteins
C to supply energy
D to supply vitamins

7 Which energy transfer takes place in photosynthesis?
A chemical energy to kinetic energy
B kinetic energy to light energy
C electrical energy to light energy
D light energy to chemical energy

8 Which feature of a leaf adapts it for absorption of sunlight?

A air spaces in the spongy mesophyll

B a large surface area

C a waterproof cuticle over the upper epidermis

D stomata in the lower epidermis

9 When leaves photosynthesise, they make carbohydrates.
In what form is the carbohydrate transported to other parts of the plant?

A cellulose

B glucose

C starch

D sucrose

10 Which factor could **not** be a limiting factor for photosynthesis?

A carbon dioxide concentration

B light intensity

C oxygen concentration

D low temperature

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Question 2:

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This question combines ideas about digestion, protein synthesis, homeostasis and excretion.

The following is a list of valid points that could be included in your answer. In your answer, it is important that you do not bullet point them, but link your ideas together. Marking points are made from:

- the size of protein molecules means that they must be broken down into amino acids to be absorbed into the blood
- amino acids are taken to the liver in the blood and distributed to the cells
- in the cells, amino acids are assembled into body proteins
- using instructions in the genetic code
- proteins synthesised in the cytoplasm, in a ribosome, according to the instructions provided by a messenger molecule
- excess amino acids are taken to the liver and converted to ammonia
- ammonia is toxic are converted to urea, which is excreted by the kidneys
- protein and amino acids are used to provide energy at times of starvation

Question 3:

Describe the similarities and differences between photosynthesis and respiration. [6 marks]

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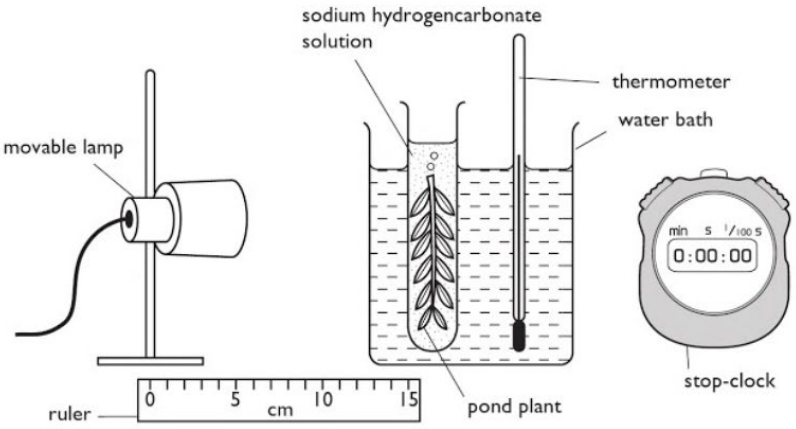
Describe the similarities and differences between photosynthesis and respiration. [6 marks]

Answer **six** from:

- respiration: uses glucose and oxygen [1] and produces carbon dioxide and water [1]
- photosynthesis: uses carbon dioxide and water [1] and produces glucose and oxygen [1] - carbon dioxide + water → glucose + oxygen
- respiration occurs in all living cells
- photosynthesis only occurs in chlorophyll in chloroplasts
- respiration occurs at all times, whereas photosynthesis only occurs in the light
- respiration is exothermic (it releases energy)
- photosynthesis is endothermic (it requires energy)

Question 4

A student set up the apparatus shown in the diagram to investigate the effect of carbon dioxide concentration on the rate of photosynthesis of a pond plant. The student used five similar pieces of pond plant and five different concentrations of sodium hydrogencarbonate ($NaHCO_3$) solution, which provides the carbon dioxide. The student counted the number of bubbles produced by the pond plant over a period of five minutes.



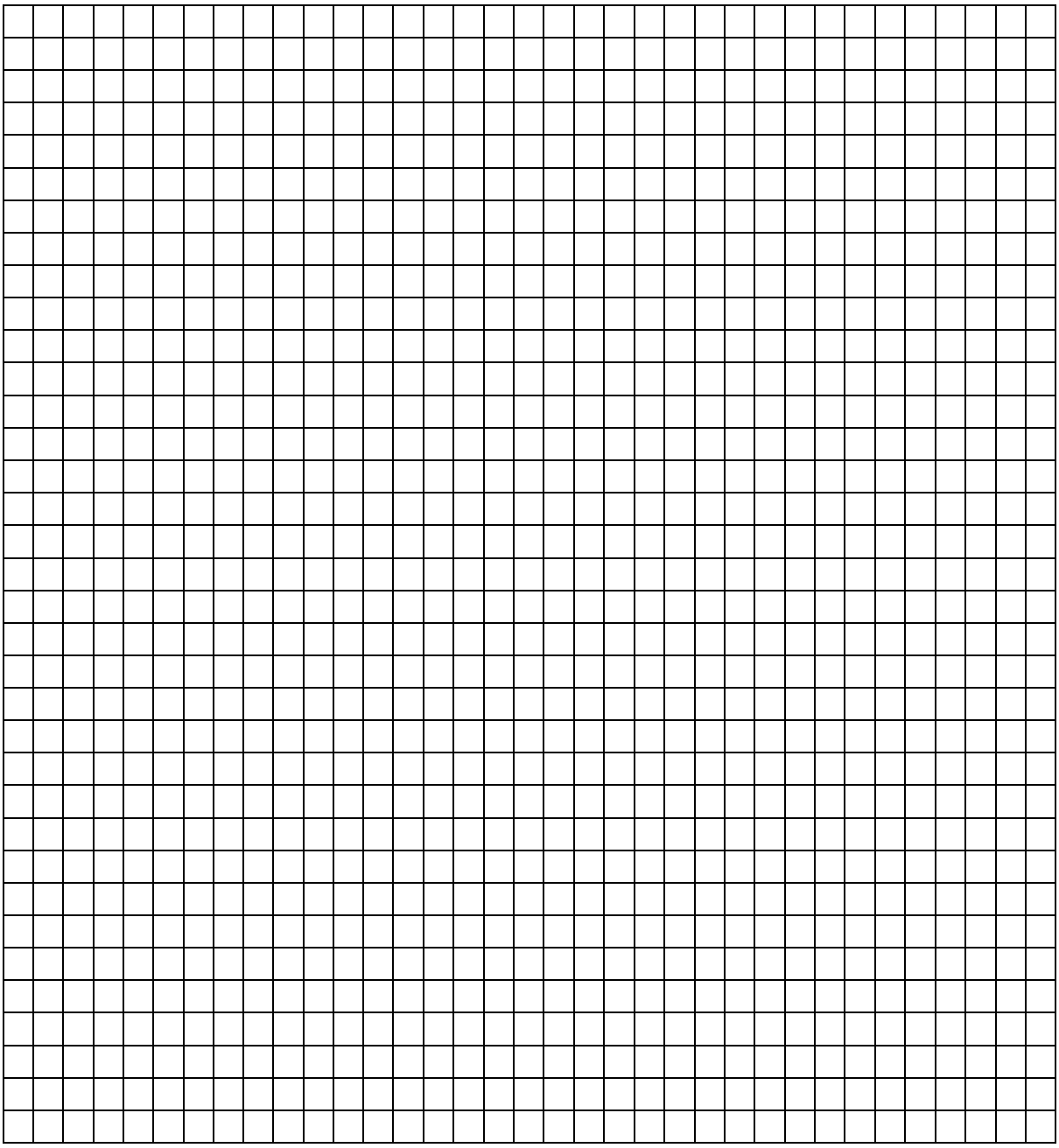
a Explain how the student made sure that the results were due only to the change in carbon dioxide concentration. [4]

The student repeated the investigation at each concentration and calculated the rate of photosynthesis. The student's results are shown in the table below.

Carbon dioxide concentration / %	Rate of photosynthesis / number of bubbles per minute			
	1st	2nd	3rd	mean
0	3	2	4	3
0.1	6	4	5	5
0.2	12	7	11	
0.3	14	15	16	15
0.4	18	22	21	20
0.5	19	23	21	21

b i Calculate the mean rate of photosynthesis when the carbon dioxide concentration was 0.2%. **[1]**

ii Plot the results from the table on graph paper. Draw an appropriate line on the graph to show the relationship between carbon dioxide concentration and the rate of photosynthesis. [2]



c Explain the effect of increasing carbon dioxide concentration on the rate of photosynthesis up to 0.4% as shown in your graph. [2]

d Suggest the result that the student would get if a carbon dioxide concentration of 0.6% was used and explain your answer. [3]

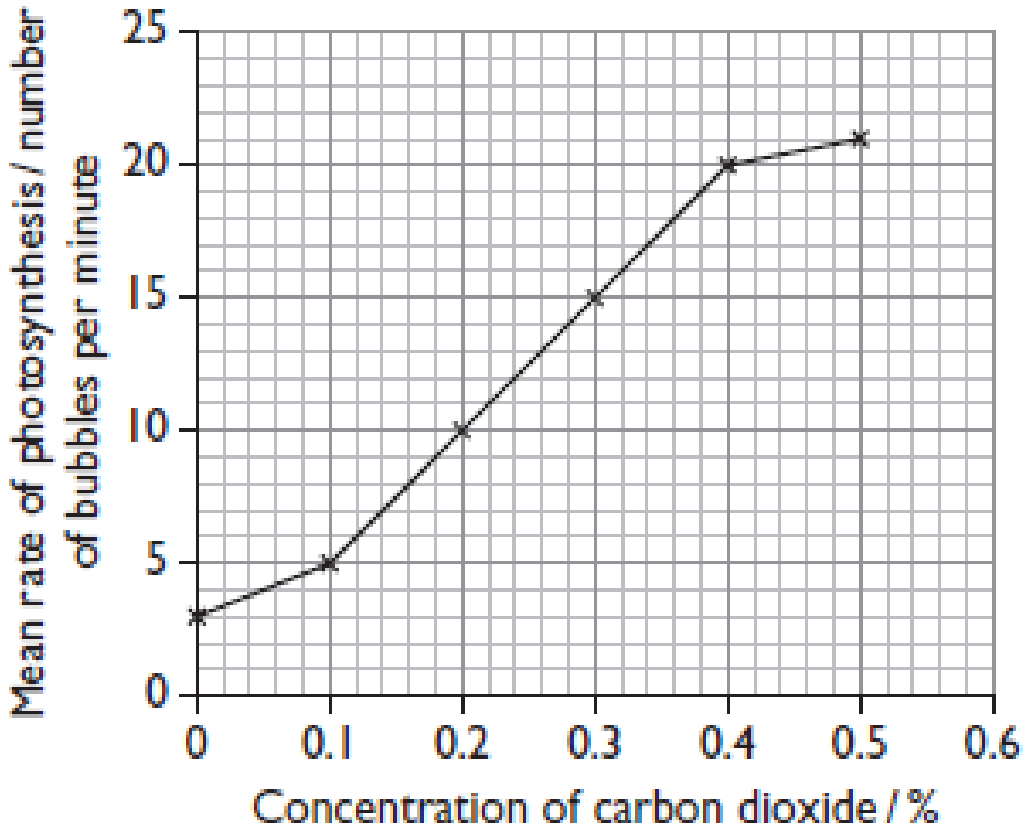
e The student used tap water as the 0% carbon dioxide concentration. Explain why the student recorded some bubbles being produced. **[1]**

8 a

- lamp kept at the same distance / light intensity kept constant;
- similar pieces of pond plant used;
- temperature kept constant / reference to water bath and thermometer;
- number of bubbles counted over the same time period;
- same volume of solution in the test tube; **[max 4]**

b i 10; **[1 mark]**

ii



suitable scales on both axes **and** fully labelled; all points correctly plotted **and** straight lines
drawn between points / best fi t line drawn; **[2 marks]**

c

rate of photosynthesis increases; carbon dioxide is used in photosynthesis; carbon dioxide is a limiting factor; **[max 2]**

d

any number between 19 and 23; explanation about how the line was extrapolated;

carbon dioxide is not a limiting factor; temperature / light intensity, may be a limiting factor; **[max 3]**

e

tap water contains some dissolved carbon dioxide; bubbles may have contained oxygen from photosynthesis; **[max 1]**