Cambridge Assessment International Education

Investigating the effect of changing temperature on respiration in yeast – Topic questions

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
4	2017	June	31
4	2017	June	32
5(b)	2017	June	33
5	2018	June	42
5	2018	June	43
6	2018	November	33
5	2017	November	41

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

4 Choose words from the list to complete the sentences about respiration.

Each word may be used once, more than once or not at all.

alcohol **carbon dioxide** **glucose**

glycerol **lactic acid** **oxygen** **water**

During exercise muscle cells can respire anaerobically and convert ..... to ..... .

When yeast cells respire anaerobically they produce ..... and ..... .

[4]

[Total: 4]

4 **(a)** Use words from the list to complete the definition of ***anaerobic*** *respiration*.

Each word may be used once, more than once or not at all.

carbon dioxide **cells** **chemical** **chloroplasts** **energy**

nucleus **nutrient** **oxygen** **physical**

The ..... reactions in ..... that break down .....

molecules to release energy without using ..... . [4]

(b) 100 g of glucose releases 1600 kJ of energy during aerobic respiration.

The energy released during anaerobic respiration is only 5% of the energy released during aerobic respiration.

(i) Calculate the energy released from 100 g of glucose during **anaerobic** respiration.

Show your working.

..... kJ
[2]

(ii) State **two** substances made by **aerobic** respiration.

1 .....

2 .....
[2]

(iii) State **three** uses of the energy released by respiration in the body.

1 .....

2 .....

3 .....
[3]

(c) State **one** way anaerobic respiration in muscles during vigorous exercise differs from the anaerobic respiration that occurs in yeast.

.....

.....

.....[1]

(d) State **one** industrial process that uses anaerobic respiration in yeast.

.....

.....[1]

[Total: 13]

(b) Yeast can be added to the apple juice to make cider by anaerobic respiration.

(i) Define the term *anaerobic respiration.*

.....

.....

.....[2]

(ii) As well as making alcohol, the anaerobic respiration of yeast can be used to make other useful products.

State the name of **one** of these products.

.....[1]

(iii) Yeast can also respire aerobically.

State **two** ways aerobic respiration differs from anaerobic respiration in yeast.

1 .....

.....

2 .....

.....
[2]

5 Fig. 5.1 shows an adult fly, *Chrysomya megacephala*.

Fig. 5.1

(a) State **three** visible features from Fig. 5.1 that could be used to distinguish adult insects from other arthropods.

1 .....

2 .....

3 .....

[3]

(b) Fly larvae are immature insects that are often used in experiments on respiration.

Give the balanced chemical equation for aerobic respiration.

..... [2]

(c) A respirometer is shown in Fig. 5.2. It can be used to estimate an organism's rate of respiration.

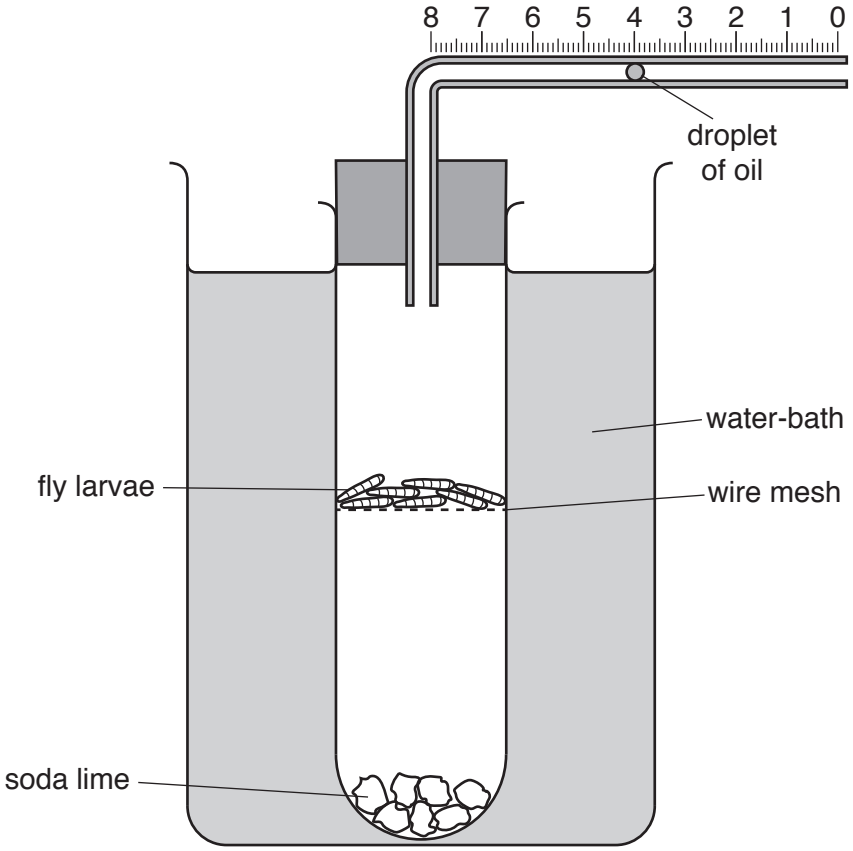

Fig. 5.2

(i) Complete the sentences:

A respirometer can be used to calculate the ..... of oxygen used by the fly larvae by measuring the ..... the droplet of oil moves in one minute. A water-bath is used to ..... the temperature of the apparatus.

[3]

(ii) The soda lime in the respirometer absorbs carbon dioxide.

Explain why this is important in this investigation.

.....

.....

..... [1]

(iii) Fly larvae respire to release energy.

State **two** uses of energy in a fly larva.

1 .....

2 .....

[2]

(d) A student used a respirometer to investigate the effect of temperature on the rate of respiration of germinating seeds.

Predict the results of this investigation and explain your prediction.

prediction .....

.....

.....

explanation .....

.....

.....

.....

.....

.....

[4]

[Total: 15]

5 **(a)** State the balanced chemical equation for aerobic respiration.

.....[2]

(b) Students investigated the rate of respiration of crickets (a type of insect) using a carbon dioxide sensor and laptop as shown in Fig. 5.1. The sensor was fitted inside an airtight glass jar. The apparatus was set up in a room with a constant temperature of 17 °C.

Fig. 5.1

The students found that the concentration of carbon dioxide inside the jar increased by 50 ppm in 120 seconds.

Calculate the rate of carbon dioxide production as ppm per second.

Show your working and express your answer to two significant figures.

..... ppm s^{-1} [1]

(c) After 10 minutes, the students opened the jar by removing the sensor. They left the jar open for 5 minutes but made sure that the crickets remained in the jar. They then replaced the sensor and took more readings for another 10 minutes.

State **and** explain one reason for opening the jar after 10 minutes.

.....

.....

.....

.....

.....[2]

(d) During the investigation the temperature inside the jar increased. The temperature outside the jar remained constant.

Explain why the temperature inside the jar increased.

.....

.....

.....

.....

.....[2]

(e) Researchers in Chile also investigated the rate of respiration in crickets.

They investigated the effect of temperature and body mass on the rate of respiration. They measured the rate of oxygen consumption in crickets with different body masses, at different temperatures.

The researchers' results are shown in Fig. 5.2.

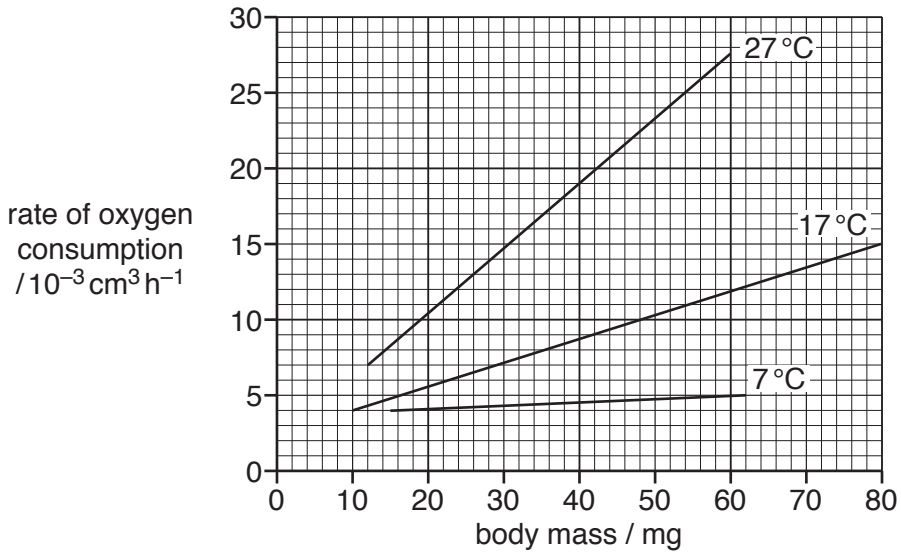

Fig. 5.2

State **two** conclusions that can be made from the data in Fig. 5.2 **and** support each conclusion with evidence from the graph.

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.....

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.....[4]

[Total:11]

6 A factory uses biotechnology to process apples.

Some of the apple juice is mixed with yeast and used to make ethanol.

(a) (i) State the type of respiration in yeast that produces ethanol.

.....[1]

(ii) State the name of the substance in apple juice that is converted to ethanol by yeast.

.....[1]

(b) The yeast uses enzymes to produce ethanol.

(i) Define the term *enzyme*.

.....

.....[2]

Fig. 6.1 shows apparatus used to find the best (optimum) temperature for making ethanol.

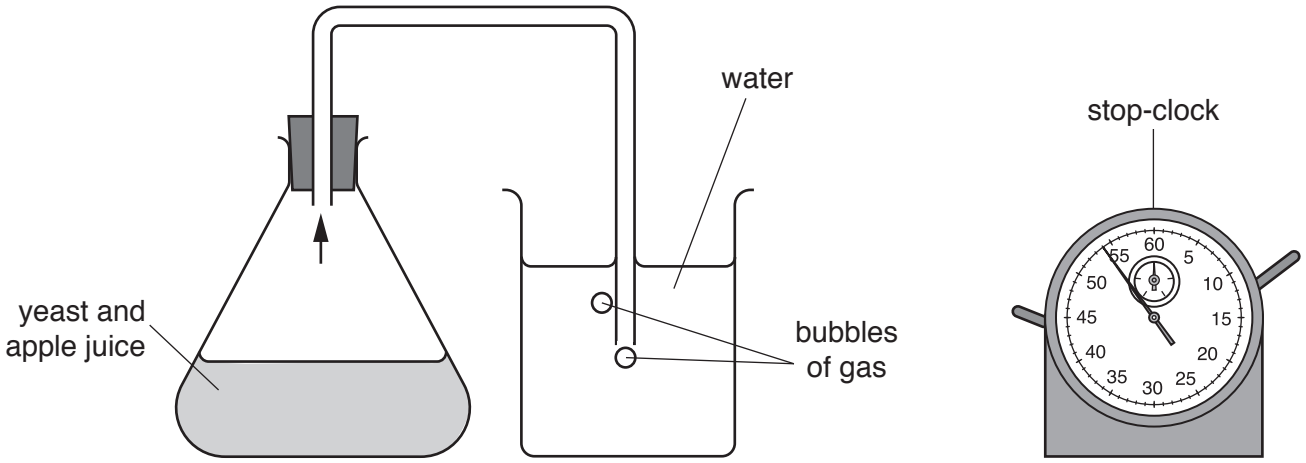

Fig. 6.1

The same apparatus was used at different temperatures.

The rate of ethanol production was compared by counting the number of bubbles of gas produced by the yeast and apple juice mixture per minute.

(ii) State the name of the gas produced by the yeast in Fig. 6.1.

.....[1]

The results of the investigation are shown in Fig. 6.2.

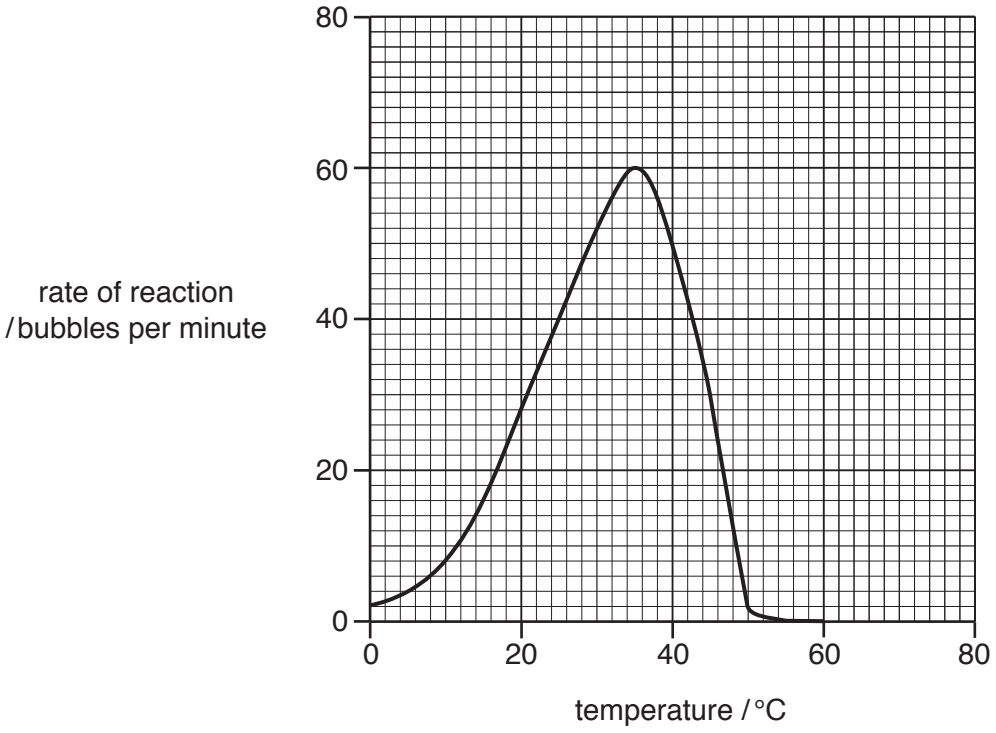

Fig. 6.2

(iii) Calculate the increase in the rate of reaction from 20 °C to 25 °C in Fig. 6.2.

Space for working.

..... bubbles per minute [1]

(iv) State the optimum temperature for the reaction shown in Fig. 6.2.

..... °C [1]

(c) The cut surface of an apple usually turns brown when exposed to air. This is caused by enzymes.

Three slices of apple were given different treatments and were then exposed to air for 30 minutes.

Table 6.1 shows the treatments and appearance of the apple slices.

Table 6.1

apple slice	pH	temperature / °C	appearance of the apple slice at 0 minutes	appearance of the apple slice after 30 minutes
A	6	20	white	brown
B	2	20	white	white
C	6	4	white	white

Suggest why slice **B** and slice **C** did not turn brown after 30 minutes.

slice **B** .....

.....

slice **C** .....

.....

[2]

(d) The enzyme pectinase is used in industry for the production of apple juice.

Explain why pectinase is used when making apple juice.

.....

.....

.....

.....

.....

.....

.....[3]

(e) Hygienic conditions are required in an apple juice factory.

Describe **three** precautions workers should take to ensure that good food hygiene is maintained in the apple juice factory.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

[Total: 15]

5 **(a)** Yeast can respire aerobically and anaerobically.

State the balanced chemical equation for aerobic respiration by yeast.

.....[2]

(b) When yeast respires anaerobically, ethanol is released.

Ethanol is a type of sustainable resource that can be produced from a wide range of crops. It can be used as a biofuel.

Table 5.1 summarises some information about crops that are used to make biofuel.

Table 5.1

crop	biofuel produced	energy yield / GJ per ha	optimum growth temperature / °C	optimum annual rainfall range / mm
wheat	ethanol	53–84	24	800–1200
corn	ethanol	63–76	18	360–1000
sugar beet	ethanol	110–122	18	360–1000
sugar cane	ethanol	110–140	28	800–1200
oil palm	oil	150–166	28	1100–2500

(i) Uruguay has an average temperature range of 12 °C to 24 °C and an average annual rainfall of 1000 mm.

Suggest **and** explain which crop would be the **most** suitable crop to grow for producing biofuel in Uruguay.

Use the information in Table 5.1 to justify your choice.

.....

.....

.....

.....

.....

.....

.....[3]

(ii) Sugar cane requires soil with high concentrations of nitrogen and potassium.

Describe how the lack of nitrate ions would affect the production of sugar cane.

.....

.....

.....

.....

.....

.....

.....[3]

(iii) Researchers in Brazil are considering using microscopic algae that live in water to produce biofuels. They have found that algae can produce a maximum amount of energy of 200 GJ per m^2.

1 m^2 = 0.0001 ha

Convert the production of biofuel from algae into GJ per ha.

Space for working.

..... GJ per ha [1]

(iv) Suggest why people who are concerned about the environment want countries to produce more biofuel from algae rather than the crops listed in Table 5.1.

.....

.....

.....

.....

.....

.....

.....[3]

(c) Define the term *sustainable development*.

.....

.....

.....[2]

[Total: 14]

Question	Answer	Marks	Guidance
4	glucose ; lactic acid ; alcohol ; carbon dioxide ;	**4**	

Question	Answer	Marks	Guidance
4(a)	chemical ; cells ; nutrient ; oxygen ;	**4**	
4(b)(i)	80 (kJ) ;;	**2**	1 mark for correct working if answer wrong 1600 x 0.05 or equivalent calculation
4(b)(ii)	carbon dioxide ; water ;	**2**	either order
4(b)(iii)	muscle contraction / muscle doing work / (muscle) movement ; metabolism / enzyme reactions / chemical reactions / digestion; protein synthesis ; cell division / cell repair; active transport ; growth ; passage of nerve impulses ; maintenance of a constant body temperature ; excretion;	**3**	**I** exercise **A** reproduction **A** shivering / keep warm / homeostasis
4(c)	(muscle produces) lactic acid ; **ora** **or** (muscle) does not produce carbon dioxide / ethanol / alcohol ; **ora**	**1**	**A ora** only if yeast stated
4(d)	brewing / making alcoholic drinks / making beer / bread-making / biofuels / making ethanol / making carbon dioxide ;	**1**	**A** fermentation

Question	Answer	Marks	Guidance
5(b)(i)	(chemical reaction in cells that) breaks down, nutrient molecules, to release energy ; without using oxygen ;	**2**	
5(b)(ii)	biofuel / bread / carbon dioxide ;	**1**	**A** yeast extract / 'marmite' / CO_2 **I** any named alcohol
5(b)(iii)	uses oxygen ; releases more energy / makes more ATP ; produces water ; does not produce alcohol / ethanol ; AVP ;	**2**	e.g. produces more carbon dioxide

Question	Answer	Marks	Guidance
5(a)	three pairs of legs ; three (named) body segments ; wings ; (pair of) antennae ; compound eyes ;	**3**	
5(b)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	**2**	one mark for correct symbols one mark for correct balancing
5(c)(i)	volume ; distance / length ; control / maintain / regulate / stabilise / keep / constant / sustain ;	**3**	
5(c)(ii)	carbon dioxide will affect, results / volume of gas (in respirometer) / carbon dioxide could kill the larvae ;	**1**	**A** to measure (changes in) oxygen only
5(c)(iii)	growth / development ; active transport ; protein synthesis ; cell division / mitosis ; passage of nerve impulses ; muscle contraction ; AVP ; e.g. metabolism / (description of) metamorphosis	**2**	**A** movement / breathe / egestion /digestion / excretion

Question	Answer	Marks	Guidance
5(d)	*prediction* as temperature increases the respiration rate will increase **; ora** and then decrease **;** *explanation:* there will be an optimum temperature (at a particular temperature) for seed germination **;** *ref to* (respiratory / germination) enzymes **;** at high temperatures enzymes denature / described **;** at low temperatures not enough (kinetic) energy for, effective collisions / biochemical reactions / respiration / digestion **; ora** AVP **;**	**4**	max 3 for explanation e.g. temperature will also affect the gas pressure in the respirometer

Question	Answer	Marks	Guidance
5(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy released) ;;	**2**	one mark for correct symbols one mark for correct balancing
5(b)	0.42 (ppm s^{-1}) ;	**1**	
5(c)	to allow oxygen to enter the chamber ; keep the crickets respiring aerobically ; to remove carbon dioxide ; to prevent death of crickets ; *ref. to* ethical treatment of animals ; maintaining similar conditions / resetting, for repeat readings / AW ;	**2**	
5(d)	heat (energy) is released by crickets ; movement / *ref. to* kinetic energy ; pressure increase ; increased carbon dioxide leading to greenhouse effect ; small closed space ;	**2**	
5(e)	rate of oxygen consumption increases with body mass of crickets (for each temperature) ; any suitable data quote comparing rate at different masses (at same temperature) ; rate of oxygen consumption increases with temperature ; any suitable data quote comparing rate at two temperatures (for the same body mass) ;	**4**	**A** respiration for oxygen consumption

Question	Answer	Marks	Guidance
6(a)(i)	anaerobic ;	**1**	
6(a)(ii)	glucose / sugar ;	**1**	
6(b)(i)	a protein ; that functions as a (biological) catalyst ;	**2**	
6(b)(ii)	carbon dioxide ;	**1**	
6(b)(iii)	12 (bubbles per minute) ;	**1**	
6(b)(iv)	35 (°C) ;	**1**	
6(c)	*slice B:* pH (too) low / acidic / not optimum pH / enzymes stops working at this pH / AW ; *slice C:* temperature (too) low / cold / not optimum temperature ;	**2**	
6(d)	increases the quantity of juice produced / AW ; speeds up the, process / reaction ; breaks down pectin ; makes clearer juice ; AVP ;	**3**	
6(e)	(named) protective clothing / clothing only worn at the factory ; example of personal hygiene ; cleaning, factory / equipment / clothing ; AVP ;	**3**	

Question	Answer	Marks	Guidance
5(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow$; $6H_2O + 6CO_2$;	**2**	max one mark if not balanced
5(b)(i)	sugar beet ; (one of three crops that) falls with appropriate temperature range / **ora** ; sugar beet / corn requirement for rainfall, is in the range ; wheat requires more rainfall ; corn / wheat, has a lower productivity / energy yield ; appropriate use of data ;	**3**	wheat and corn also grow in suitable temp.(ecf) **A** sugar beet has a higher energy yield than wheat (or corn).
5(b)(ii)	stunted / reduced / no, growth / yield ; used to make amino acids / proteins ; amino acids converted to proteins ; named molecule containing nitrogen ;	**3**	e.g. DNA, enzymes, chlorophyll
5(b)(iii)	$200 \div 0.0001$ $2\,000\,000 \div 2 \times 10^6$;	**1**	
5(b)(iv)	less land required ; crops can be used as food (rather than fuel) ; less habitat destruction / less deforestation ; less disruption to food chains / greater diversity maintained ; comparison of algae yield with any crop from Table 5.1, with units ; AVP ;	**3**	
5(c)	development that provides for the needs of an (increasing) human (population) ; without harming the natural environment / ecosystems / habitat ;	**2**	