PAG 10 Data Loggers and Computer Modelling: OCR A Level Biology Exa

7 questions · 13 marks · about 16 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · information from earlier in the question

(b) Fig. 1.2 represents the volume changes in the lung of a human.

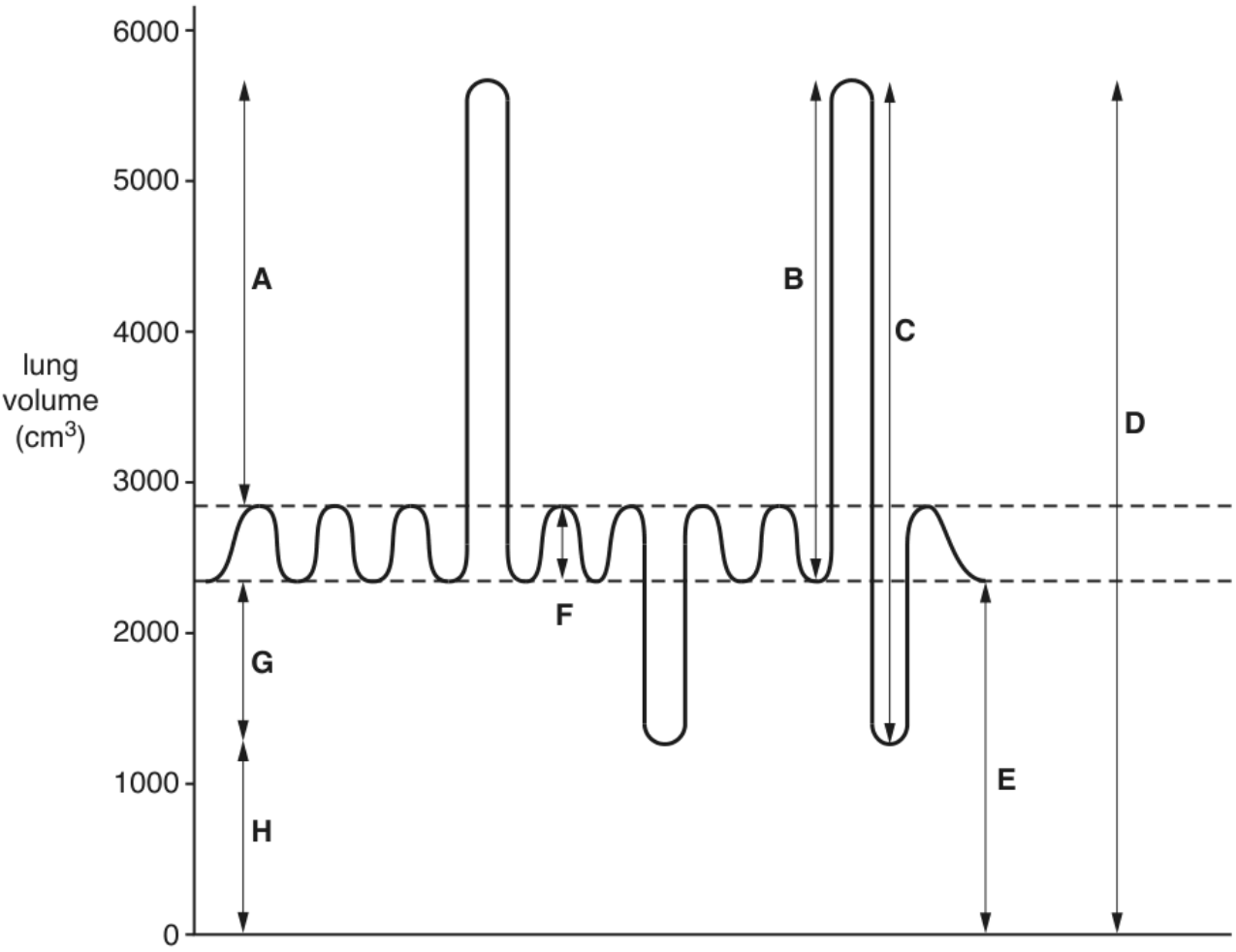

Fig. 1.2

(i) Select the letter, **A** to **H**, that corresponds to each of the following lung volumes.

The first one has been done for you.

Lung volume	Letter
Inspiratory reserve volume	*A*
Residual volume	
Total lung capacity	
Tidal volume	
Vital capacity	

[4]

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Question 1 · AS Paper 2 · June 2016 · Q1(b)(ii) · 2 marks

(ii) Volume **C** can be measured using an instrument such as a spirometer.

What **breathing** instructions would be given to a person whose volume **C** was being measured?

.....

.....

.....

.....

..... **[2]**

Question 2 · information from earlier in the question

23 **Fig. 23.1** shows a spirometer trace of a student at rest breathing for one minute.

The trace shows a period of resting breathing, followed by a maximum inhalation and exhalation.

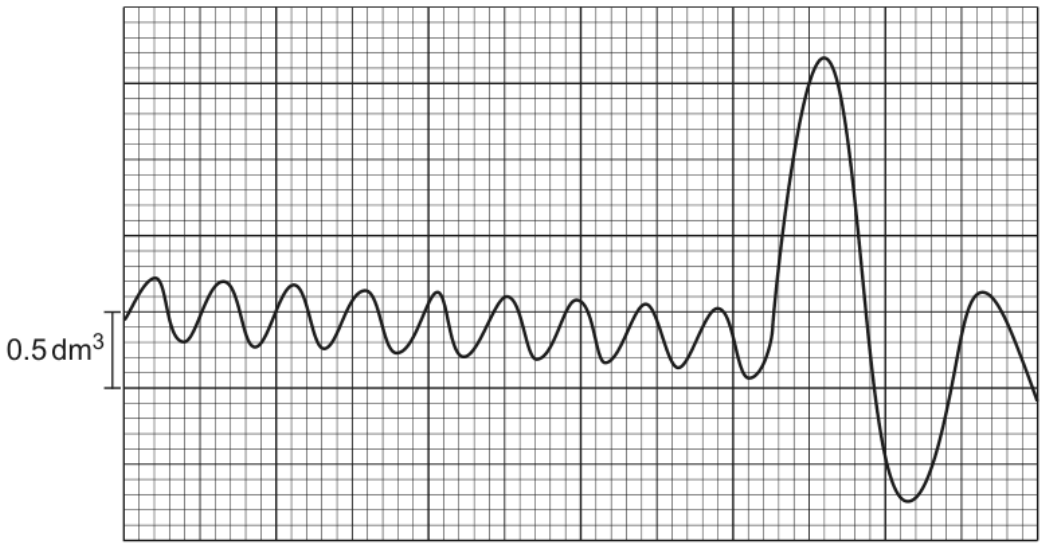

Fig. 23.1

(a) **(i)** Explain why there is a downward trend in the trace.

.....

..... **[2]**

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Question 2 · AS Paper 1 · November 2021 · Q23(a)(ii) · 2 marks

(ii) Using **Fig. 23.1**, calculate the mean resting breathing rate.

Mean = ...breaths per minute **[2]**

Question 3 · A level Paper 1 · June 2022 · Q20(a)(i) · 2 marks

20 (a) *Oplegnathus insignis* is a fish species that lives in salt water. It may be suitable for use in fish farming.

Scientists investigated the growth of *O. insignis* at different temperatures to help decide on the optimum temperature for farming.

Fig. 20.1 shows a diagram of the respirometer the scientists used.

The diagram shows a single fish, but the respirometer is large enough to hold many.

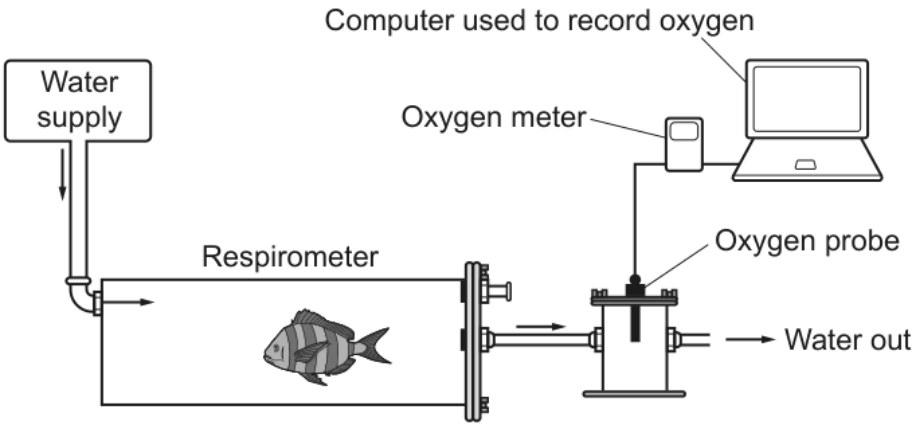

Fig. 20.1

(i) Suggest **two** modifications the researcher would need to make to this apparatus to investigate the effect of temperature on the rate of respiration.

1 .....

.....

2 .....

.....

[2]

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Question 4 · A level Paper 1 · June 2022 · Q20(a)(ii) · 1 mark

(ii) Suggest **one** advantage of using a computer to collect data.

.....

..... **[1]**

Question 5 · A level Paper 3 · June 2017 · Q2(b)(iv) · 3 marks

(iv) A group of students were designing an experiment to investigate the effect of temperature on the respiration rate of *S. cerevisiae*.

Their planned method included the following:

- *S. cerevisiae* yeast suspension will be divided into six equal volumes to form the experimental groups.
- Six temperatures will be tested: 15 °C, 20 °C, 25 °C, 30 °C, 35 °C and 40 °C.
- Beakers of *S. cerevisiae* will be placed in water baths to control the temperature.
- Respiration rate will be measured by using a pH probe to monitor changes in the pH of the suspensions.
- The experiment will be repeated four times.

Evaluate whether the students' method is likely to produce **valid** results.

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..... **[3]**

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Question 6 · information from earlier in the question

(b) A scientist investigated the rate of photosynthesis in lesser pondweed, *Potamogeton pusillus*.

The method used is outlined below:

- Add 200 cm^3 of distilled water to a 300 cm^3 glass beaker.
- Dissolve 5 g of $NaHCO_3$ in the water to provide an excess of CO_2.
- Place the beaker in a water bath at 10 °C and leave for 10 min to equilibrate.
- Insert an oxygen sensor into the water in the beaker and measure the baseline O_2 concentration.
- Place 100 g of *P. pusillus* into the beaker.
- Remove all other light sources from the room and place an LED light source 20 cm above the top of the beaker.
- Use a light intensity meter to ensure the light intensity above the beaker is 5000 lux.
- Measure the concentration of oxygen dissolved in the water using a data logger every 10 min for 200 min.
- Carry out four more repeats at 10 °C.
- Repeat all the above steps in water baths at 15 °C, 20 °C, 25 °C and 30 °C.

(i) Identify the following variables from the scientist's method:

independent variable

.....

dependent variable

.....

one control variable

.....

[3]

Question 6 · A level Paper 1 · June 2019 · Q22(b)(ii) · 1 mark

(ii) Identify **one** variable that was **not** controlled in the scientist's method.

..... **[1]**

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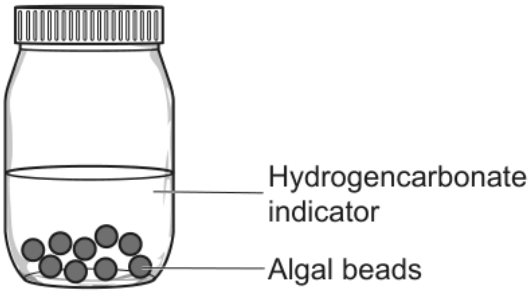
Question 7 · information from earlier in the question

19

(a) A student investigates the effect of light intensity on the rate of photosynthesis in algae that had been immobilised in calcium alginate to make algal beads.

The student places the algal beads in small screw-cap bottles containing hydrogencarbonate indicator.

The indicator turns from orange to red and then purple as CO_2 is removed from the solution.



The student uses the time taken for the indicator to turn purple as a measure of the rate of photosynthesis.

(i) State **two** variables that the student should keep constant during this experiment.

1 .....

.....

2 .....

.....

[2]

(b) The student wants to use the algal beads method to investigate the effect of CO_2 concentration on the rate of photosynthesis.

(i) Explain why it would **not** be possible to use the hydrogencarbonate indicator method to investigate the effect of CO_2 concentration.

.....

.....

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..... **[2]**

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Question 7 · A level Paper 1 · June 2025 · Q19(b)(ii) · 2 marks

(ii) Suggest how the student could modify the method so the effect of CO_2 concentration on the rate of photosynthesis could be measured.

.....

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..... **[2]**

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Mark schemes

Question 1 · AS Paper 2 · June 2016 · Q1(b)(ii) · 2 marks

1	(b)	(ii)	1 breathe in as deeply as possible / AW ✓ 2 (and) then force as much air out as possible ✓
			Total

2	**IGNORE** ref to using nose clip If they have the deepest breath out before the deepest breath in, then **max 1** (for correct mp 2) 1 e.g. 'breathe in as much as possible' 'inhale as much as you can' 'inhale to maximum' 'breathe in all the air that you can' 2 e.g. 'breathe out as hard as possible' 'exhale as much as you can' 'exhale to maximum' 'breathe out all the air that you can' **DO NOT CREDIT** *all* of the air pushed out of lungs
11	

Question 2 · AS Paper 1 · November 2021 · Q23(a)(ii) · 2 marks

23	(a)	(ii)	13 ✓✓	2	**ALLOW** 12.8 – 13 **ALLOW** one mark for: 9 breaths in 42s 8 breaths in 37s **ALLOW** one mark for ECF for correct calculation using incorrect data

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Question 3 · A level Paper 1 · June 2022 · Q20(a)(i) · 2 marks

20	**(a)**	**(i)**	**any two from:** thermostat (to control temperature whilst taking measurements) ✓ thermometer (to monitor temperature in the respirometer chamber) ✓ oxygen probe , in water entering / before respirometer ✓	**2**

3.3	**Mark as continuous prose** **ALLOW** e.g. use heater **or** iced water to get water to (required) temperature **or** use thermostatically controlled water bath **ALLOW** temperature probe

Question 4 · A level Paper 1 · June 2022 · Q20(a)(ii) · 1 mark

20	**(a)**	**(ii)**	**any one from:** allows continual data collection ✓ less risk of error / remove human error ✓ allows for , easier / direct / immediate , data analysis ✓	**1**

3.3	**IGNORE** refs to accuracy / precision **ALLOW** person does not need to be present **ALLOW** e.g. description of experimental or operator error **ALLOW** reduces bias or results not subjective

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Question 5 · A level Paper 3 · June 2017 · Q2(b)(iv) · 3 marks

iv	*Yes because…* a suitable, range / intervals, of temperatures have been chosen ✓ volume controlled ✓ temperature , controlled / maintained ✓ repeats, to identify anomalies / outliers ✓ same yeast suspension used ✓ *No because…* availability of, oxygen/ nutrients / yeast concentration, not controlled ✓ pH is not be controlled at start of experiment ✓ *idea of* pH change would not be an accurate measure of respiration rate ✓ no time reference (to calculate rate) ✓ no control (sample) ✓

3 max	**Max 2 for statements supporting only one view** **IGNORE** large / wide, range of temperatures **IGNORE** repeats exclude anomalies **ACCEPT** 'better to collect (volume of) carbon dioxide produced' / 'It is better to use a respirometer' (implies pH change not accurate) 'because some CO_2 would diffuse into the air'

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Question 6 · A level Paper 1 · June 2019 · Q22(b)(ii) · 1 mark

(b)	(ii)	pH ✓ concentration of CO_2 ✓ age of pondweed ✓ size / surface area / number , of leaves ✓	**1 max**

IGNORE reference to equipment

ALLOW *P. pusillus* for pondweed

Question 7 · A level Paper 1 · June 2025 · Q19(b)(ii) · 2 marks

19	**(b)**	**(ii)**	measure <u>oxygen</u> production / use an <u>oxygen</u> sensor ✓ gas/ oxygen, produced/ collected, in, stated/ set, time = rate (of, oxygen production / photosynthesis) ✓ **OR** measure time taken for DCPIP to, decolourise / change colour✓ 1/time = rate (of photosynthesis) ✓	**2**	3.3

ALLOW count the <u>oxygen</u> bubbles/ use gas syringe to measure volume of <u>oxygen</u> / measure length of <u>oxygen</u> bubble
DO NOT ALLOW names of apparatus that does not match a method for measuring oxygen production in photosynthesis.
ALLOW O_2 for 'oxygen'

DO NOT ALLOW CO_2 for gas
ALLOW measure time taken to produce set volume of oxygen = rate

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