Q1.

(a) Describe the relationship between size and surface area to volume ratio of organisms.

_____

_____

_____

_____

_____

(1)

(b) A scientist calculated the surface area of a large number of frog eggs. He found that the mean surface area was 9.73 mm^2. Frog eggs are spherical.

The surface area of a sphere is calculated using this equation

$$\text{Surface area} = 4\pi r^2$$

where r is the radius of a sphere

$$\pi = 3.14$$

Use this equation to calculate the mean diameter of a frog egg.

Show your working.

Diameter = _____ mm

(2)

The scientist calculated the ratio of surface area to mass for eggs, tadpoles and frogs. He also determined the mean rate of oxygen uptake by tadpoles and frogs.

His results are shown in the table.

Stage of frog development	**Ratio of surface area to mass**	**Mean rate of oxygen uptake / µmol g^{-1} h^{-1}**
Egg	2904 : 1	no information

Tadpole	336 : 1	5.7
Adult	166 : 1	1.3

(c) The scientist used units of μmol g^{-1} h^{-1} for the rate of oxygen uptake.

Suggest why he used μmol in these units.

(1)

(d) The scientist decided to use the ratio of surface area to mass, rather than the ratio of surface area to volume. He made this decision for practical reasons.

Suggest **one** practical advantage of measuring the masses of frog eggs, tadpoles and adults, compared with measuring their volumes.

(1)

(e) Explain why oxygen uptake is a measure of metabolic rate in organisms.

(1)

(f) A student who looked at these results said that they could not make a conclusion about the relationship between stage of development and metabolic rate.

Use information in the table to explain reasons why they were unable to make a conclusion.

(3)

(Total 9 marks)

Q2.

Read the following passage.

Several diseases are caused by inhaling asbestos fibres. Most of these diseases result from the build up of these tiny asbestos fibres in the lungs.

One of these diseases is asbestosis. The asbestos fibres are very small and enter the bronchioles and alveoli. They cause the destruction of phagocytes and the surrounding lung tissue becomes scarred and fibrous. The fibrous tissue reduces the elasticity of the lungs and causes the alveolar walls to thicken. One of the main symptoms of asbestosis is shortness of breath caused by reduced gas exchange.

People with asbestosis are at a greater risk of developing lung cancer. The time between exposure to asbestos and the occurrence of lung cancer is 20–30 years.

Use information in the passage and your own knowledge to answer the following questions.

(a) Destruction of phagocytes (lines 4–5) causes the lungs to be more susceptible to infections. Explain why.

(2)

(b) (i) The reduced elasticity of the lungs (lines 6–7) causes breathing difficulty. Explain how.

(2)

(ii) Apart from reduced elasticity, explain how changes to the lung tissue reduce the efficiency of gas exchange.

(4)

(c) (i) Doctors did not make the link between exposure to asbestos and an increased risk of developing lung cancer for many years. Use information in the passage to explain why.

(1)

(ii) Give **one** factor, other than asbestos, which increases the risk of developing lung cancer.

(1)

(Total 10 marks)

Q3.

(a) Explain the role of the diaphragm in breathing out.

(3)

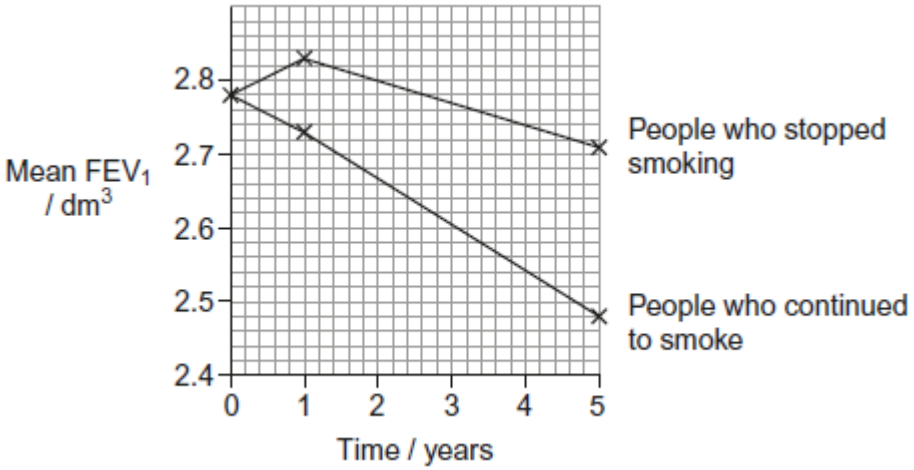
Scientists investigated the effect of stopping smoking on the forced expiratory volume of people. The forced expiratory volume (FEV_1) is the greatest volume of air that a person can breathe out in 1 second.

The scientists recruited a large number of people who smoked. Some of these smokers stopped smoking at the start of the investigation whilst others continued to smoke.

The scientists:

- measured the FEV_1 of each person and calculated the mean FEV_1
- re-measured the FEV_1 of each person after one year and calculated the mean FEV_1 of the smokers and the mean FEV_1 of the people who had stopped smoking
- repeated this at the end of five years.

The graph shows the scientists' results.



(b) Use the data shown in the graph to compare the change in FEV_1 of people who continued to smoke with those who stopped smoking.

(2)

(c) Smoking causes changes in the lungs and airways of smokers.

Suggest two changes in the lungs of people who continue to smoke that could explain the change in their FEV_1.

1. _____

_____

2. _____

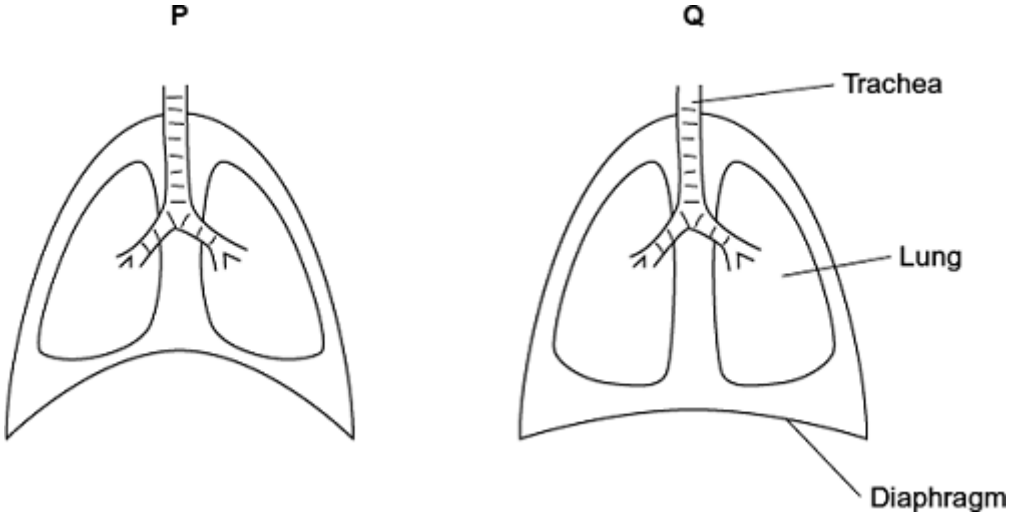
_____

(2)

(Total 7 marks)

Q4.

The diagram shows the position of the diaphragm at times **P** and **Q**.



(a) Describe what happens to the diaphragm between times **P** and **Q** to bring about the change in its shape.

_____

_____

_____

_____

_____

(2)

(b) Air moves into the lungs between times **P** and **Q**. Explain how the diaphragm causes this.

_____

_____

_____

_____

(Extra space)

(3)

(c) Describe how oxygen in air in the alveoli enters the blood in capillaries.

(2)

(Total 7 marks)

Q5.

(a) (i) Name the structure through which gases enter and leave the body of an insect.

(1)

(ii) Name the small tubes that carry gases directly to and from the cells of an insect.

(1)

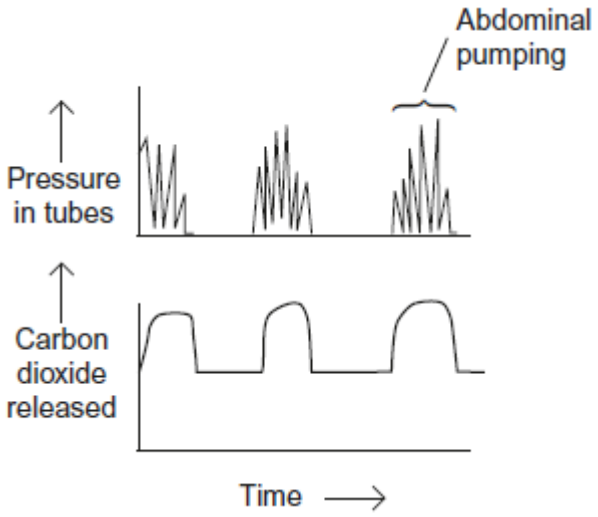
(b) Explain the movement of oxygen into the gas exchange system of an insect when it is at rest.

(3)

(c) Abdominal pumping takes place during vigorous activity in insects. This causes regular squeezing of the tubes of the gas exchange system.

A scientist investigated the effect of abdominal pumping on the pressure in the tubes and the volume of carbon dioxide released by the insect.

Her results are shown below.



Describe and explain these results.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q6.

A scientist used grasshoppers to investigate the effect of composition of air on breathing rate in insects. He changed the composition of air they breathed in by varying the concentrations of oxygen and carbon dioxide.

The scientist collected 20 mature grasshoppers from a meadow. He placed the grasshoppers in a small chamber where he could adjust and control the composition of air surrounding them. The small chamber restricted the movement of the grasshoppers.

His results for three of the grasshoppers are shown in the table below in the form in which he presented them.

Percentage of oxygen and carbon dioxide in different types of air breathed in by grasshoppers			
A Air from atmosphere	**B Pure oxygen**	**C Gas mixture 1**	**D Gas mixture 2**

Gas	**Oxygen**	20.9	100.0	91.0	84.0
	Carbon dioxide	0.1	0.0	9.0	16.0
Breathing rate of grasshopper in different types of air / breaths per minute	**Grasshopper 1**	53	11	99	107
	Grasshopper 2	48	25	88	99
	Grasshopper 3	61	13	96	93

(a) The percentages of oxygen and carbon dioxide in Column **A** do **not** add up to 100% but in columns **C** and **D** they do.
Suggest **two** reasons for this difference.

1. _____

_____

2. _____

_____

(2)

(b) Use all the data to describe the effect of concentration of carbon dioxide on the breathing rate of grasshoppers.

_____

_____

_____

_____

_____

_____

[Extra space] _____

_____

_____

(3)

(c) One of the different types of air was similar to the air in the meadow where the

grasshoppers were collected. It provides data that might be used to calculate a mean breathing rate for grasshoppers in the meadow.

(i) Use the data to estimate the mean breathing rate of the three grasshoppers in the meadow. Show your working.

Mean breathing rate = _____ breaths per minute

(2)

(ii) The estimate does not provide a reliable value for the mean breathing rate of all insect species in the meadow.
Other than being an estimate, suggest and explain **three** reasons why this value would **not** be reliable.

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

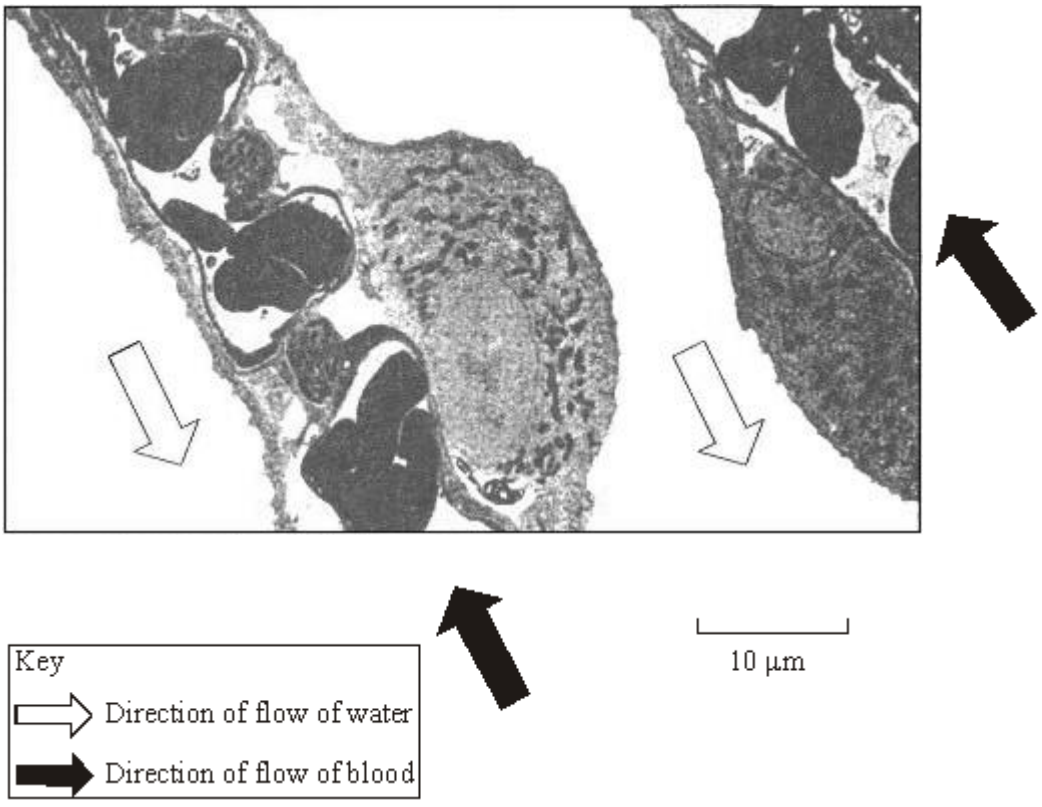
_____

(3)

(Total 10 marks)

Q7.

The electron micrograph shows a section through a fish gill. The directions of flow of water and of blood are indicated by arrows.



Source: www.ucdavis.edu/mjguinan

(a) Calculate the minimum distance that a molecule of oxygen would have to travel from the water to a red blood cell. Give your answer in micrometres and show your working.

Answer _____ µm.

(2)

(b) Explain how the relationship between the direction of flow of water and of blood shown in the micrograph is useful to a fish.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q8.

(a) The photograph shows part of the gill of a fish as seen through a light microscope. It is magnified × 400.

(i) Explain how the structure of the gill makes oxygen uptake efficient.

_____

_____

_____

_____

(2)

(ii) Water containing dissolved oxygen flows over the gill in the opposite direction to the blood flow inside. Explain why this arrangement is important for efficient oxygen uptake.

_____

_____

_____

_____

(2)

(b) There is a one-way flow of water over the gills of a fish whereas there is a two-way flow of air in the lungs of a mammal. Suggest **one** advantage to a fish of this one-way flow of water over its gills.

_____

_____

(1)

(Total 5 marks)

Q9.

(a) Describe and explain how fish maintain a flow of water over their gills.

_____

_____

(4)

(b) Describe and explain how the structure of the mammalian breathing system enables efficient uptake of oxygen into the blood.

(6)

(Total 10 marks)

Q10.

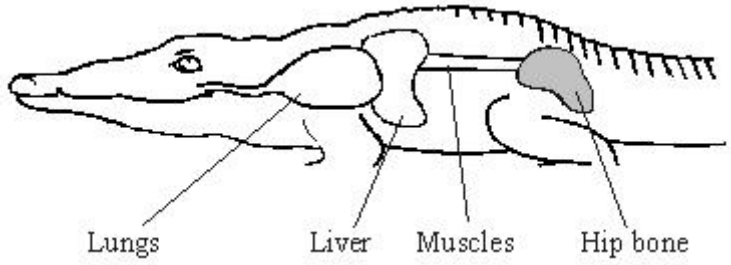
Read the following passage.

When a person breathes in, the diaphragm muscle contracts and the diaphragm flattens. This, together with movement of the ribs, leads to air being drawn into the lungs. Breathing out is generally passive and results from the relaxation of the diaphragm muscle and the elastic recoil of the lung tissue.

5 Two sets of intercostal muscles also play an important part in breathing in humans. Contraction of the external intercostal muscles is associated with breathing in. During strenuous exercise, contraction of the internal intercostal muscles helps force air out of

the lungs. In this case, breathing out is active.

Crocodiles also have lungs and breathe air. They have well developed intercostal
10 muscles but do not appear to use these during breathing. They also lack a diaphragm. Breathing in, in crocodiles, is brought about by contraction of muscles attaching the liver to the hip bones (see diagram). This pulls the liver back and causes air to enter the lungs. Breathing out results from the contraction of abdominal muscles which move the liver forwards.



Use information in the passage and your own knowledge to answer the questions.

(a) Describe the movement of the ribs when a person breathes in (line 2).

_____

_____

(1)

(b) (i) Explain what is meant by passive (line 3).

_____

_____

(1)

(ii) Is breathing out in crocodiles active or passive? Explain your answer.

_____

_____

(1)

(c) Explain how movement of the liver causes air to enter a crocodile's lungs.

_____

_____

_____

_____

_____

_____

(3)

(d) Describe the difference in the composition of gases in inhaled and exhaled air.

Explain how these differences are caused.

(6)

(Total 12 marks)

Q11.

Some people have a medical condition called pancreatitis. This can lead to their pancreatic duct becoming blocked. As a result, a high concentration of amylase is found in their blood.

At 12-hour intervals, a doctor measured the concentration of amylase in the blood of a person suffering from a blocked pancreatic duct. He also measured the concentration of amylase in the blood of a healthy person.

The figure below shows his results.

	Concentration of amylase in the blood / arbitrary units	
Time / hours	**Person with blocked pancreatic duct**	**Healthy person**
0	1800	800
12	2200	750

24	2500	700
36	2000	750
48	1400	800

(a) (i) The changes in concentration of amylase in the blood of a person with a blocked pancreatic duct are different from those of a healthy person during the period shown in the figure above.

Describe **two** of these differences.

1. _____

_____

_____

2. _____

_____

_____

(2)

(ii) In a person with a blocked pancreatic duct, starch digestion is affected. Explain how.

_____

_____

_____

_____

_____

(2)

(b) Healthy people have amylase in their blood. This does not cause any harmful effects in the body.
Explain why.

_____

_____

_____

_____

_____

(2)

(c) Pancreatitis can lead to the release of protein-digesting enzymes into the blood.

This is harmful to the body.
Suggest **one** reason why.

_____

_____

_____

_____

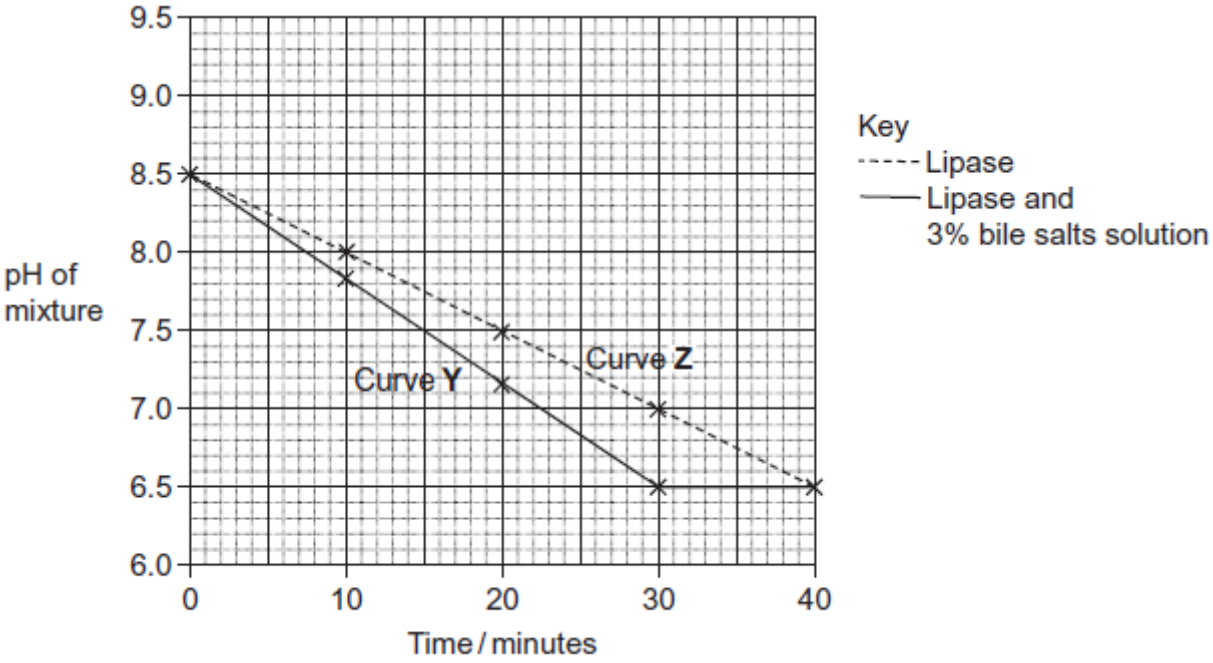
_____

(2)

(Total 8 marks)

Q12.

Scientists investigated the effect of lipase and a 3% bile salts solution on the digestion of triglycerides. The graph below shows their results.



The scientists also incubated triglycerides with different concentrations of bile salts. After 30 minutes they measured the diameter of the triglyceride droplets. They used the results to calculate the mean radius of the droplets at each concentration. The table below shows their results.

Concentration of bile salts /%	0	1	2	3	4	5
Mean radius of triglyceride droplet / μm	6	5	4	3	2	1

(a) Describe how you would use a microscope to find the mean diameter of triglyceride droplets on a slide.

(Extra space)

(3)

(b) (i) The ratio of mean radius of triglyceride droplets in bile salts at a concentration of 0% to the mean radius in bile salts at a concentration of 3% is 2 : 1.

What is the ratio of their surface areas? Show your working.

You can calculate the surface area of a droplet from the formula

$$A = 4\pi r^2$$

Where A = surface area
r = radius
π = 3.14

(2)

(ii) Use the data in the table to explain the difference between curves **Y** and **Z** in the graph.

(Extra space)

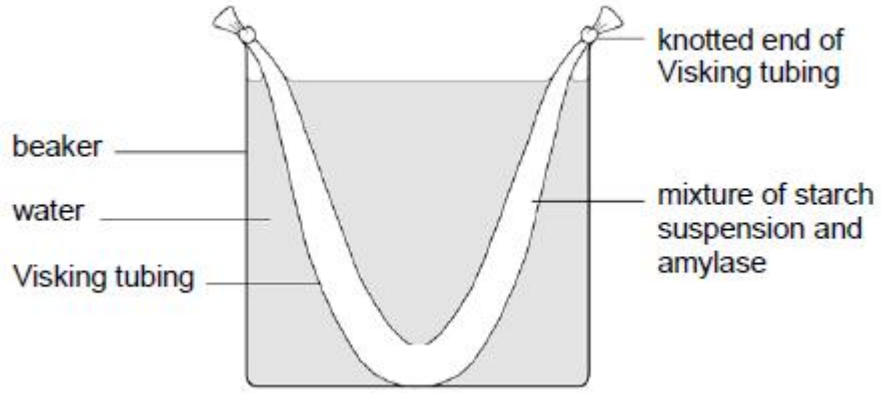
(3)
(Total 8 marks)

Q13.

(a) Cells lining the ileum of mammals absorb the monosaccharide glucose by co-transport with sodium ions. Explain how.

(3)

A student set up the experiment shown in the diagram below.



The material from which Visking tubing is made is partially permeable.

After 15 minutes, the student removed samples from the liquid in the beaker and from the liquid inside the Visking tubing. She carried out biochemical tests on these samples. She drew the table below to record her results.

(b) Complete the table by placing a tick (✓) in each box that you expect to have shown a positive result.

Biochemical test	Liquid from beaker	Liquid inside Visking tubing

Biuret reagent		
Iodine in potassium iodide		
Benedict's solution		

(3)

(c) Justify your answers to part **(b)**.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q1.

(a) As size increases, ratio (of surface area to volume) decreases;

Accept converse.

Comparison required, e.g., smaller organisms have a larger ratio

1

(b) Two marks for correct answer in range of 1.75 to 1.76032;;

Accept for 1 mark, incorrect answer using radius 0.87 / 0.88 / 0.880 / 0.8802 / 0.88015;

OR

Accept for 1 mark, incorrect answer with correct rearranged equation, e.g.,

Radius = $\sqrt{(\text{surface area} \div 4\pi)}$

OR

$= \sqrt{9.73 \div 12.56}$

OR

$= \sqrt{0.77} / \sqrt{0.774} / \sqrt{0.775}$

OR

r^2 *= surface area ÷ 4* π

OR

$r^2 = 9.73 \div 12.56$

OR

$r^2 = 0.77 / 0.774 / 0.775$

2

(c) (Measures) small uptake / amount / quantity / volume / concentration / rate (of oxygen uptake);

OR

Avoids use of powers of ten / standard form / many decimal places;

Ignore weight / accuracy

1

(d) More accurate / less error (in measuring mass);

OR

Causes less distress / damage to animal (to measure mass);

OR

Easier / quicker (to find mass) **because** irregular shapes;

OR

Fewer measurements / calculations;

*Ignore references to **human** error*

Accept converse if reference made to volume

Reject if comparison is made with surface area.

1

(e) (Oxygen used in) respiration, **which** provides energy / ATP;

OR

(Oxygen is used in) respiration, **which** is a metabolic process / chemical

reaction;

Reject produces energy

Reject references to anaerobic respiration

1

(f) 1. No information about egg;

2. So cannot compare all stages (in Table 2);

Idea of comparing all three stages needed

3. No statistical information / test / t-test / comparison of standard deviations;
OR
No measure of significant differences;

Reject statements that "results" are not significant

Reject references to chi squared or correlation coefficient

3

[9]

Q2.

(a) Phagocytes engulf / ingest pathogens / microorganisms / bacteria / viruses;

Phagocytes destroy pathogens / microorganisms / bacteria / viruses;

Lung diseases are caused by pathogens / microorganisms / bacteria / viruses;

Q *Allow description of process of engulfing*

2 max

(b) (i) Alveoli / lungs will not inflate / deflate fully / reduced lung capacity;

Breathing out particularly affected / no longer passive;

2

(ii) Alveolar walls thicken;

Longer diffusion pathway;

Scarred / fibrous tissue;

Reduces surface area (for gaseous exchange);

Q *Diffusion is essential for 2nd point and surface area for 4th point.*

4

(c) (i) Cancer develops 20 – 30 years after exposure (to asbestos);

1

(ii) Smoking / air pollution / specified industrial source;

1

[10]

Q3.

(a) 1. Diaphragm moves up /becomes dome shaped;
2. Reduces volume of thorax / increase pressure in thorax;

Accept 'space' for volume, chest/lungs for thorax

3. Pressure in thorax **higher** than outside (air);

Accept chest/lungs

3

(b) 1. FEV_1 of those who have stopped smoking increased after 1 year whereas the FEV_1 of smokers decreased;

Comparison required

2. (Between years 1 and 5, FEV_1 of both decreases but) the rate of decrease in FEV_1 of smokers is faster than those who stopped smoking;

Idea of a faster rate of decrease in smokers, not just quoting final FEV values

2

(c) 1. Airways are narrowed/blocked;
2. Excess mucus (in airway);
3. Inflammation (of airways);
4. Elasticity is lost/scar tissue builds up;

Ignore answers in the context of reduced surface area of alveoli or increased diffusion distance

2 max

[7]

Q4.

(a) 1. Flatten / moves down;

1. Ignore: additional information about rib movements

2. (Diaphragm muscle) contracts;

2

(b) 1. Diaphragm contracts / moves down / flattens;

Ignore refs to rib movement

2. Increases volume (of thorax) and decrease in pressure;

2. Accept pressure lower than atmospheric pressure

3. Air moves from high to lower pressure / down pressure gradient;

3. Reject: by diffusion

3

(c) 1. Diffusion;

Accept down diffusion gradient

2. Across (alveoli) epithelium / (capillary) endothelium;

2. Accept: capillary epithelium / squamous cell

2 max

[7]

Q5.

(a) (i) Spiracle;

Accept: Spiracles

1

(ii) Tracheole/trachea;

Accept: Tracheoles/tracheae

Ignore: System

1

(b) 1. Oxygen used in (aerobic) respiration;

2. (so) oxygen (concentration) gradient (established);

Accept description of gradient

Ignore: 'along gradient idea' unless direction is made clear

Ignore: movement through gas/water

Reject: gradient in wrong direction

3. (so) oxygen diffuses in; 2 and 3.

Accept: oxygen moves down a diffusion gradient for 2 marks

3

(c) 1. Abdominal pumping/pressure in tubes linked to carbon dioxide release;

MP1 relates to description of link shown in graphs

2. (Abdominal) pumping raises pressure in body;

Needs idea of causation, not just description of correlation

3. Air/carbon dioxide pushed out of body /air/carbon dioxide moves down pressure gradient (to atmosphere);

Reject ref to concentration gradients/diffusion

3

[8]

Q6.

(a) 1. Other gases / nitrogen / water vapour in atmosphere / **A**;

2. Only oxygen and carbon dioxide in gas mixtures / **C** and **D**;

3. Composition of / gases in **A** not controlled / composition of gas mixtures / **C** and **D** controlled.

2 max

(b) 1. Breathing rate *lowest* when no carbon dioxide / in (pure) oxygen / B;

Idea of 'lowest' must be stated.

2. (Generally) presence of carbon dioxide increases breathing rate / as concentration of carbon dioxide increases breathing rate increases / there is a positive correlation;

A general point incorporating all concentrations.

3. Breathing rate increases when (carbon dioxide) higher than 0.1% / concentration in atmosphere / A;

This MP requires a specific comparison to 0.1% or the atmospheric concentration.

Accept 'gas mixtures 1 and 2 / C and D' for 'higher carbon dioxide'.

4. Breathing rate of **grasshopper 3** falls in D / 16% / gas mixture 2 (whereas others increase).

Restating data alone is insufficient for any mark point.

3 max

(c) (i) 54;

OR

1. Correct data / column **A** chosen;

   A correct answer of 54 gets 2 marks.

   MP1 and MP2 allow a possible mark for an incorrect calculation or choice of wrong data.

2. Correct calculation of mean from data chosen;

   Check − the three values must be from same column.

2 max

(ii)
1. Small sample / only 3 (grasshoppers)
   so may not be representative (of all grasshoppers / insects);
2. Grasshoppers are not the only insects / species;
   so genetic / behavioural / metabolic differences;
3. (Insects) not all mature / are at different stages of development / different sizes;
   so different metabolic rates;
4. Movement not restricted / not at rest in meadow;
   so (rate of) respiration higher;
5. (Naturally-occurring) carbon dioxide concentration lower in meadow;
   so breathing rate lower;

   Explanations required, therefore both parts of answer required for credit in each marking point.

   Accept appropriate converse answers.

   Accept 'respiration' for 'metabolism' and vice versa.

3 max

[10]

Q7.

(a) $\frac{10}{20} \times measurment$ / $\frac{1}{2} \times measurement$;

= 1.25 to 1.5;

allow 1 mark if correct working shown

max 2

(b) Maintains concentration gradient (over whole length of gill) / diffusion can occur over whole gill;
More oxygen enters blood (/ more CO_2 leaves);
More (aerobic) respiration / more energy release in muscle / for swimming; *'more' needed ONCE only*

3

[5]

Q8.

(a) (i) one feature;
then linked Explanation;

(many) filaments / lamellae / secondary lamellae;
so large surface area;

large number of capillaries; (NOT "good blood supply")

maintains a diffusion gradient / removes oxygen;

thin epithelium / lamellae wall;
short diffusion pathway;

2

(ii) maintains diffusion / concentration gradient / equilibrium not reached;
diffusion occurs across whole length (of lamellae / gill);

2

(b) less energy needed / continuous flow of water or O_2;

1

[5]

Q9.

(a) 1. mouth opens, operculum / opercular valve shuts;
2. floor of mouth lowered;
3. water enters due to decreased pressure / increased volume;
4. mouth closes, operculum / opercular valve opens;
5. floor raised results in increased pressure / decreased volume;
6. high / increased pressure forces / pushes water over gills;

4 max

(b) 1. alveoli provide a large surface area;
2. walls of alveoli <u>thin</u> to provide a short diffusion pathway;
3. walls of capillary <u>thin</u> / close to alveoli provides a short diffusion pathway;
4. walls (of capillaries / alveoli) have flattened cells;
5. cell membrane permeable to gases;
6. many blood capillaries provide a large surface area;
7. intercostal / chest muscles / diaphragm muscles / to ventilate lungs / maintain a diffusion / concentration gradient;
8. wide trachea / branching of bronchi / bronchioles for efficient flow of air;
9. cartilage rings keep airways open;
(*reject moist and thin membranes*)

6 max

[10]

Q10.

(a) up and out;

1

(b) (i) does not require work / effort / involve muscle contraction / energy expenditure;

1

(ii) active as it involves contraction of muscles;

1

(c) liver moves back;
increases volume of lungs;
pressure lower (in lungs than outside);

3 max

(d) *maximum of three marks for description, points 1 to 4*

1 inhaled air contains more oxygen than exhaled air;

2 inhaled air contains less carbon dioxide than exhaled air;

3 inhaled air contains less water (vapour);

4 relative amount / percentage of nitrogen also changes;

5 respiration results in lower blood oxygen / higher blood carbon dioxide;

6 oxygen enters blood / carbon dioxide leaves blood in alveoli;

7 by diffusion;

8 water vapour diffuses from moist surface;

6 max

[12]

Q11.

(a) (i) For person with pancreatitis / blocked pancreatic duct:

1. At 0 h / start higher than healthy person / higher than healthy person throughout;

2. Rises then falls whereas healthy person falls then rises;

3. At 48 h / end, below the starting value whereas healthy person is the same (as at start);

Differences required for all points

2 max

(ii) 1. Little / less / no amylase can enter small intestine;

Accept gut or intestine but reject wrong locations e.g. stomach

2. Little / less / no starch digested (in intestine);

2

(b) 1. Amylase is specific (to starch);

2. No starch in human blood / cells / tissues / starch only in plants;

2

(c) 1. Could digest own body / own proteins;

e.g. 'could digest carrier proteins in body cells' would score 2 marks

e.g. 'could digest antibodies in blood' would also score 2 marks

2. Example of protein digested e.g. membrane protein, antibody, named protein in blood;

Do not credit unsuitable example such as muscle proteins

2

[8]

Q12.

(a) Measure with eyepiece graticule / scale;
Calibrate with stage micrometer / scale on slide / object of known size;
Repeats and calculate the mean;
OR
Use a ruler to estimate the field diameter under microscope;
How many droplets go across the field;
Repeats and calculate mean;

Accept references to radius

3

(b) (i) Two mark for correct answer of 4 : 1;;
One mark for incorrect answer but working shows that candidate has clearly attempted to compare values of r^2 / 6^2 and 3^2 / 36 and 9;

Idea of comparing ratios
A ratio of 1 : 4 should gain 1 mark

2

(ii) Small droplets have a larger surface area to volume ratio;
More surface for lipase (to act), leading to faster digestion of triglycerides;
Fatty acids are produced more quickly so pH will drop more quickly in curve Y / with bile salts / less fatty acids in curve Z / without bile salts so pH drop more slowly;

3

[8]

Q13.

(a) 1. Sodium ions actively transported from ileum cell to blood;

2. Maintains / forms diffusion gradient for sodium to enter cells from gut (and with it, glucose);

3. Glucose enters by facilitated diffusion with sodium ions;

3

(b)

Biochemical test	Liquid from beaker	Liquid inside Visking tubing
Biuret reagent		✓
I_2/KI		✓ or blank
Benedict's	✓	✓

1 mark for each correct row

3

(c) 1. Biuret: protein molecules too large to pass through tubing;

Neutral: enzyme molecules

2. Iodine in potassium iodide solution: starch molecules too large to pass through tubing;

If no tick in 04.2, allow no starch hydrolysed

3. Benedict's: starch hydrolysed to maltose, which is able to pass through tubing.
Reject: glucose

3

[9]