Respiration Pack 2

Question Paper

1 (a) Gas exchange in fish takes place in gills. Explain how **two** features of gills allow efficient gas exchange.

1. _____

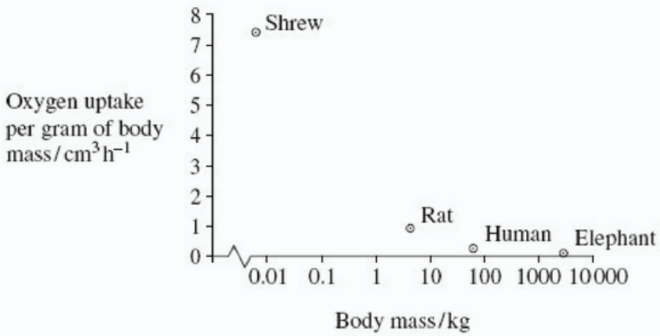
_____

2. _____

_____

(2)

(b) A zoologist investigated the relationship between body mass and rate of oxygen uptake in four species of mammal. The results are shown in the graph.



(i) The scale for plotting body mass is a logarithmic scale. Explain why a logarithmic scale was used to plot body mass.

_____

_____

(1)

(ii) Describe the relationship between body mass and oxygen uptake.

_____

_____

(1)

(iii) The zoologist measured oxygen uptake per gram of body mass. Explain why he measured oxygen uptake per gram of body mass.

_____

_____

_____

_____

(2)

(Total 6 marks)

2 (a) The biochemical pathway of aerobic respiration involves a number of different steps.

Name **one** step in which carbon dioxide is produced.

_____

(1)

In an investigation, scientists transferred slices of apple from air to anaerobic conditions in pure nitrogen gas. They measured the rate of carbon dioxide production.

(b) The scientists kept the temperature constant throughout the investigation. Explain how a decrease in temperature would affect the rate of carbon dioxide production.

_____

_____

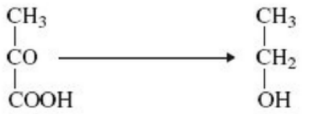
_____

_____

_____

(2)

(c) When the apple slices were transferred to nitrogen, the following biochemical pathway took place.



Pyruvic acid Ethanol

Use this pathway to explain the part played by reduced NAD when the apple slices were transferred to nitrogen.

_____

_____

_____

_____

(2)

(d) The rate of carbon dioxide production was higher when the apple slices were in nitrogen than when they were in the air. Explain why.

_____

_____

_____

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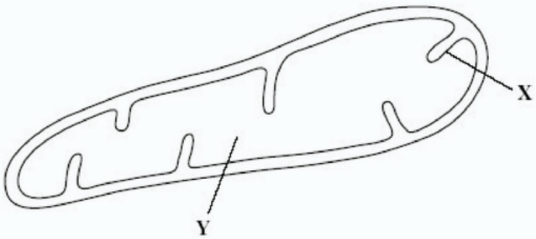
_____

_____

(3)

(Total 8 marks)

3 The diagram shows a mitochondrion.



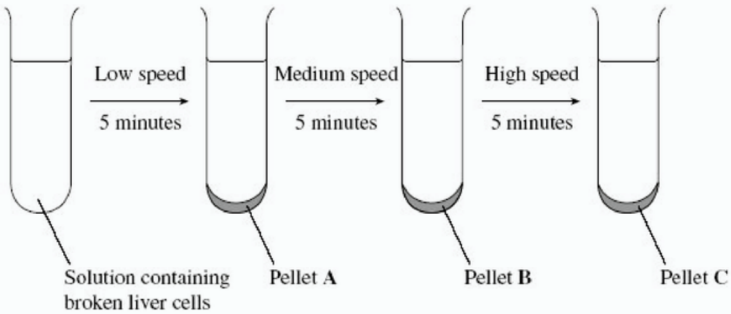
(a) Name the parts labelled **X** and **Y**.

(i) **X** _____

(ii) **Y** _____

(2)

Scientists isolated mitochondria from liver cells. They broke the cells open in an ice-cold, isotonic solution. They then used a centrifuge to separate the cell organelles. The diagram shows some of the steps in the process of centrifugation.



(b) Suggest which pellet, **A**, **B** or **C** contained the mitochondria.

☐

(1)

(c) Explain why the solution used was

(i) ice-cold

_____

_____

(1)

(ii) isotonic.

_____

_____

_____

_____

(2)

(d) People with mitochondrial disease have mitochondria that do not function properly.

Some people with mitochondrial disease can only exercise for a short time. Explain why a person with mitochondrial disease can only exercise for a short time.

_____

_____

_____

_____

(2)

(Total 8 marks)

4 The kangaroo rat is a small desert mammal. It takes in very little water in its food and it rarely drinks. Its core body temperature is 38 °C.

The kangaroo rat takes in some water by feeding and drinking. Describe another method by which the kangaroo rat could obtain water.

_____

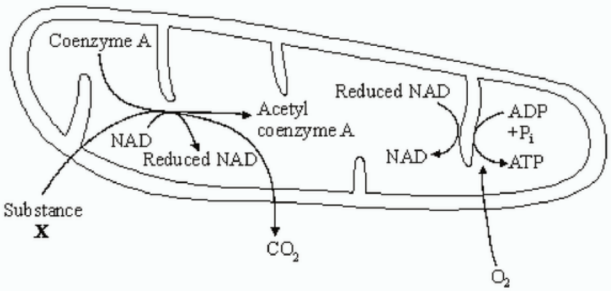
_____

_____

_____

(Total 2 marks)

5 The diagram represents two of the stages of aerobic respiration that take place in a mitochondrion.



(a) Name substance **X**.

_____

(1)

(b) Which stage of aerobic respiration takes place inside a mitochondrion and is **not** represented on the diagram?

_____

(1)

(c) Explain why oxygen is needed for the production of ATP on the cristae of the mitochondrion.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

6 **Introduction**

Resource A – D relate to a single investigation.

Scientists investigated the effect of supplying extra carbon dioxide on the yield of tomatoes growing in a glasshouse. They compared the mean yield of tomatoes from 1995 to 1997 when no extra carbon dioxide was supplied with the mean yield of tomatoes from 1998 to 2000 when extra carbon dioxide was supplied.

Resource A

Tomato plants were grown in two glasshouses, each with an area of 2000 m^2. Figure 1 shows the mean number of hours of sunshine per month during fruit production.

Figure 1

	1995 - 1997 (no extra carbon dioxide)	1998 - 2000 (extra carbon dioxide)
Mean number of hours of sunshine per month	148.91	147.00

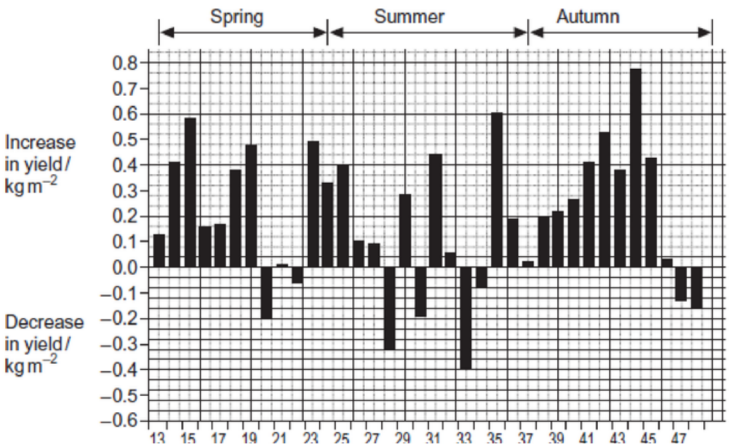
- The scientists used heating to maintain the tempera ture inside the glasshouses above 18 °C. They opened the windows to keep the tempera ture below 30 °C.
- From 1998 to 2000 they maintained the carbon dioxide concentration between 0.06 % and 0.08 % when the windows were closed and between 0.04 % and 0.05 % when the windows were open.
- The carbon dioxide concentra tion in the air outside the glasshouse was 0.04 %.

Resource B

Figure 2 shows the mean difference between the yield of tomatoes with extra carbon dioxide and the yield with no extra carbon dioxide for each week during the harvesting period.

If the yield is greater when extra carbon dioxide is supplied, the difference in yield is shown as an increase. If the yield is lower when extra carbon dioxide is supplied, the difference is shown as a decrease.

Figure 2



Resource C

Figure 3 shows the relationship between the time when the tomatoes were harvested and the yield.

Figure 3

Number of weeks from beginning of year	Mean yield per week with extra carbon dioxide / kg m^{-2}	Mean yield per week without extra carbon dioxide / kg m^{-2}
13 – 19	1.25	0.83
20 – 25	1.62	1.47
26 – 48	1.23	1.06

The commercial price for tomatoes varies with the time of year. The highest price is paid for tomatoes between weeks 13 and 19. The lowest price is paid between weeks 26 and 48.

Resource D

Whiteflies are an important insect pest of tomatoes. The adults can fly from plant to plant. Their young do not have wings. The adults and young feed on the plant sap and introduce viruses into the tomato plants. Feeding and the introduction of viruses both reduce the yield of tomatoes. The scientists controlled the number of whitefly in the glasshouses by releasing parasitic wasps. The wasps lay their eggs in the young of the whitefly. The wasp eggs hatch and feed on the young whitefly, killing them.

(a) (i) An increase in carbon dioxide concentration affected the yield of tomatoes in week 35. Use **Figure 2** to describe how.

_____

_____

(1)

(ii) There was a decrease in yield when extra carbon dioxide was supplied during some weeks of the year. Use information from **Resource A** to suggest why.

_____

_____

(1)

(b) Using **Figure 3**, calculate the percentage increase in yield when extra carbon dioxide was added for weeks 13 to 19. Show your working.

Percentage increase _____

(2)

(c) Additional information is required for tomato growers to decide whether it is economically profitable to add extra carbon dioxide to produce very early tomatoes.

Give **two** pieces of information that the growers would require.

1. _____

_____

2. _____

_____

(2)

(d) Adding extra carbon dioxide during the summer (weeks 24 – 36) is unlikely to be profitable. Use data from the resource sheet explain why.

_____

_____

_____

_____

(2)

(e) The control experiment in this investigation was when data were collected with no extra carbon dioxide added. Some scientists said this control experiment was not satisfactory. Explain how you could improve the control experiment.

_____

_____

_____

_____

(2)

(Total 10 marks)

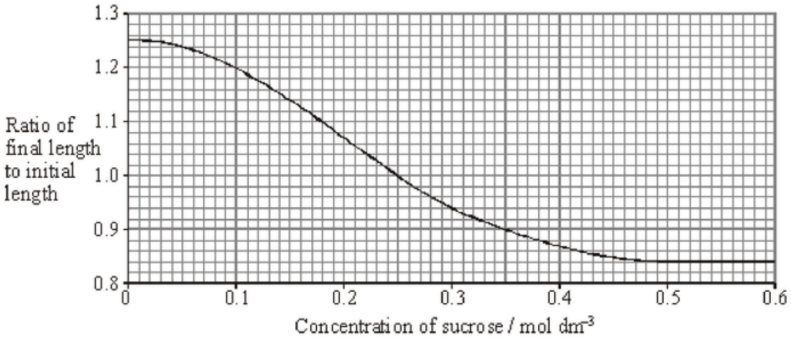
7 (a) Discs of carrot were placed in a solution containing potassium ions (K^+). The concentration of oxygen in air bubbled through the solution was changed and the rates of respiration and uptake of potassium ions were measured. The results are shown in the table.

Concentration of oxygen / %	Rate of respiration / arbitrary units	Rate of uptake of potassium ions / arbitrary units
2.7	31	29
12.2	69	72
20.8	90	80

Describe and explain the link between oxygen concentration, rate of respiration and rate of uptake of potassium ions.

(4)

(b) Cylinders of potato were cut using a cork borer. Their initial lengths were measured. Each cylinder was then put in a different concentration of sucrose solution for 12 hours. The graph shows the changes in length of the potato cylinders in the different sugar solutions.



(i) In what concentration of sucrose did the length of the potato cylinder remain the same?

_____

(1)

(ii) The initial length of the potato cylinder in the solution of concentration 0.1 mol dm^{-3} was 90 mm. Calculate its final length. Show your working.

Final length = _____ mm

(2)

(iii) Explain the change in length which occurs in a sucrose solution of concentration 0.5 mol dm^{-3}.

_____

_____

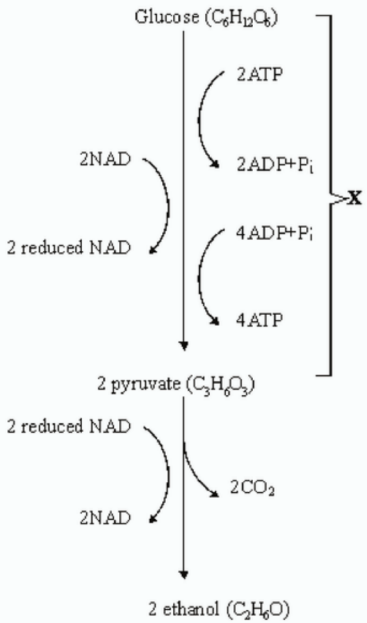
_____

_____

(2)

(Total 9 marks)

8 (a) The main stages in anaerobic respiration in yeast are shown in the diagram.



(i) Name process **X**.

_____

(1)

(ii) Give **one** piece of evidence from the diagram which suggests that the conversion of pyruvate to ethanol involves reduction.

_____

_____

(1)

(iii) Explain why converting pyruvate to ethanol is important in allowing the continued production of ATP in anaerobic respiration.

_____

_____

_____

(b) Give **two** ways in which anaerobic respiration of glucose in yeast is

(i) similar to anaerobic respiration of glucose in a muscle cell;

1. _____

_____

2. _____

_____

(2)

(ii) different from anaerobic respiration of glucose in a muscle cell.

1. _____

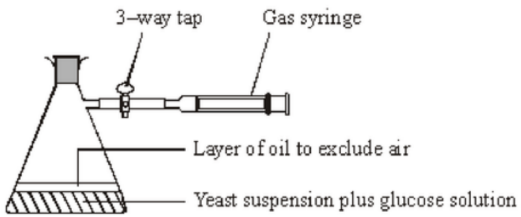
_____

2. _____

_____

(2)

(c) Some students investigated the effect of temperature on the rate of anaerobic respiration in yeast. The apparatus they used is shown in the diagram. The yeast suspension was mixed with glucose solution and the volume of gas collected in five minutes was recorded.



(i) Each student repeated the experiment and the results were pooled. Explain the advantages of collecting a large number of results.

_____

_____

_____

_____

(2)

(ii) At 30 °C, one student obtained the following results.

Volume of gas collected in 5 minutes / cm^3	Result 1	Result 2	Result 3
	38.3	27.6	29.4

Calculate the mean rate of gas production. Give your answer in $cm^3\ s^{-1}$.

Answer _____ $cm^3\ s^{-1}$

(2)

(iii) If aerobic respiration had been investigated rather than anaerobic respiration, how would you expect the volumes of gas collected at 30°C to differ from these results?

Explain your answer.

_____

_____

_____

_____

_____

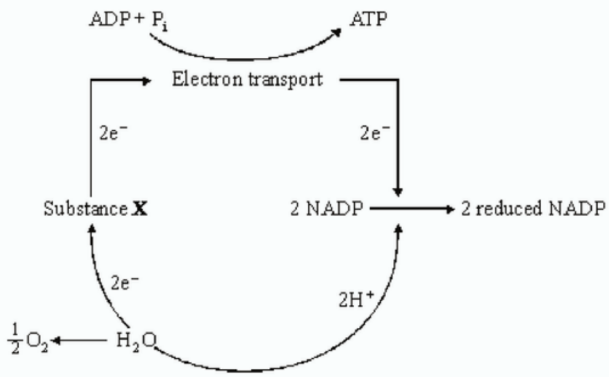
_____

(3)

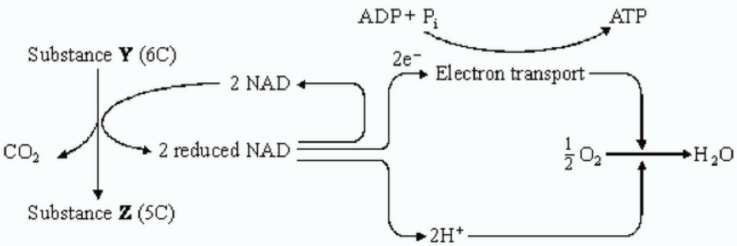
(Total 15 marks)

9 The diagram shows some of the stages in two processes that produce ATP.

Process 1



Process 2



(a) In **Process 1**, what causes substance **X** to lose electrons (e^-)?

_____

_____

(1)

(b) Where precisely, within a cell, does electron transport take place in **Process 2**?

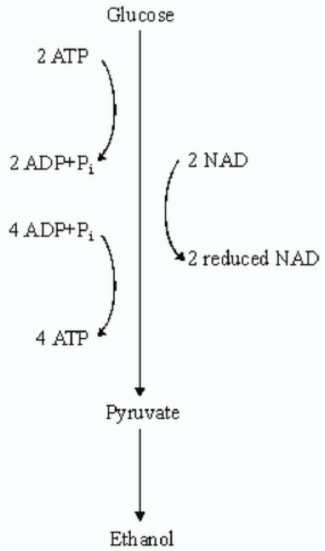
_____

_____

(1)

(Total 2 marks)

10 The diagram summarises the process of anaerobic respiration in yeast cells.



(a) (i) In anaerobic respiration, what is the net yield of ATP molecules per molecule of glucose?

_____

(1)

(ii) Give **two** advantages of ATP as an energy-storage molecule within a cell.

1. _____

_____

2. _____

_____

(2)

(b) Describe how NAD is regenerated in anaerobic respiration in yeast cells.

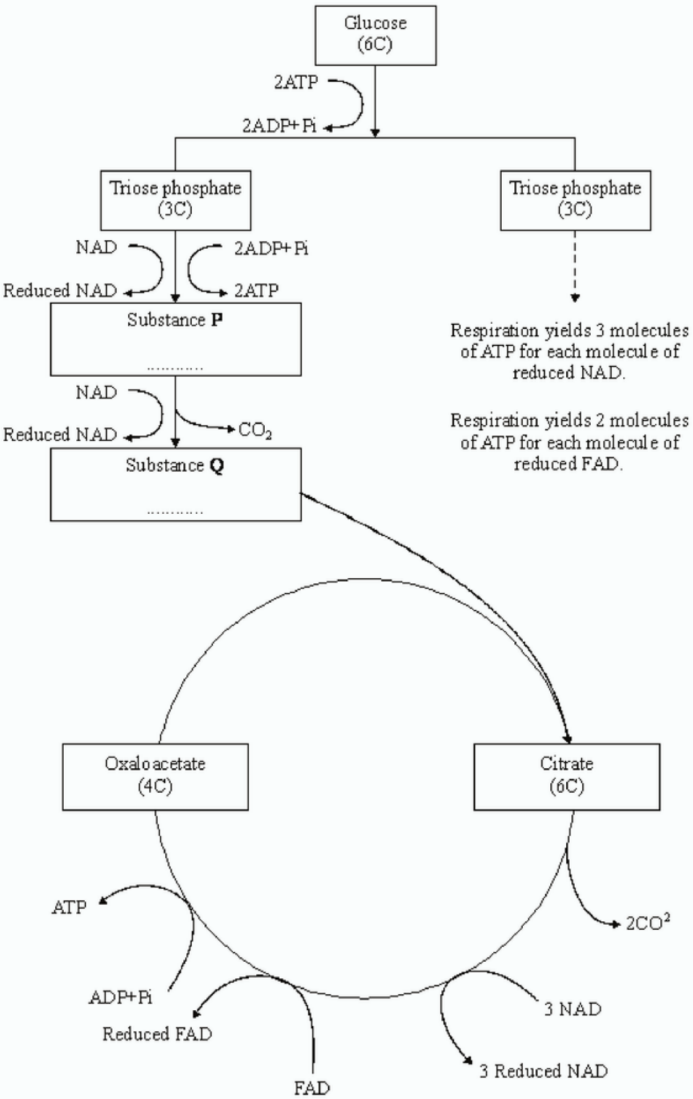
_____

_____

(1)

(Total 4 marks)

11 (a) The flow chart shows the main stages in aerobic respiration.



(i) Complete the flow chart by writing, in the appropriate boxes, the number of carbon atoms in substance **P** and the name of substance **Q**.

(2)

(ii) Some ATP is formed in the cytoplasm and some in the mitochondria. Use the information given to calculate the number of molecules of ATP formed in a mitochondrion from one molecule of glucose in aerobic respiration. Show how you arrived at your answer.

Answer _____

(2)

(iii) In the presence of oxygen, respiration yields more ATP per molecule of glucose than it does in the absence of oxygen. Explain why.

_____

_____

_____

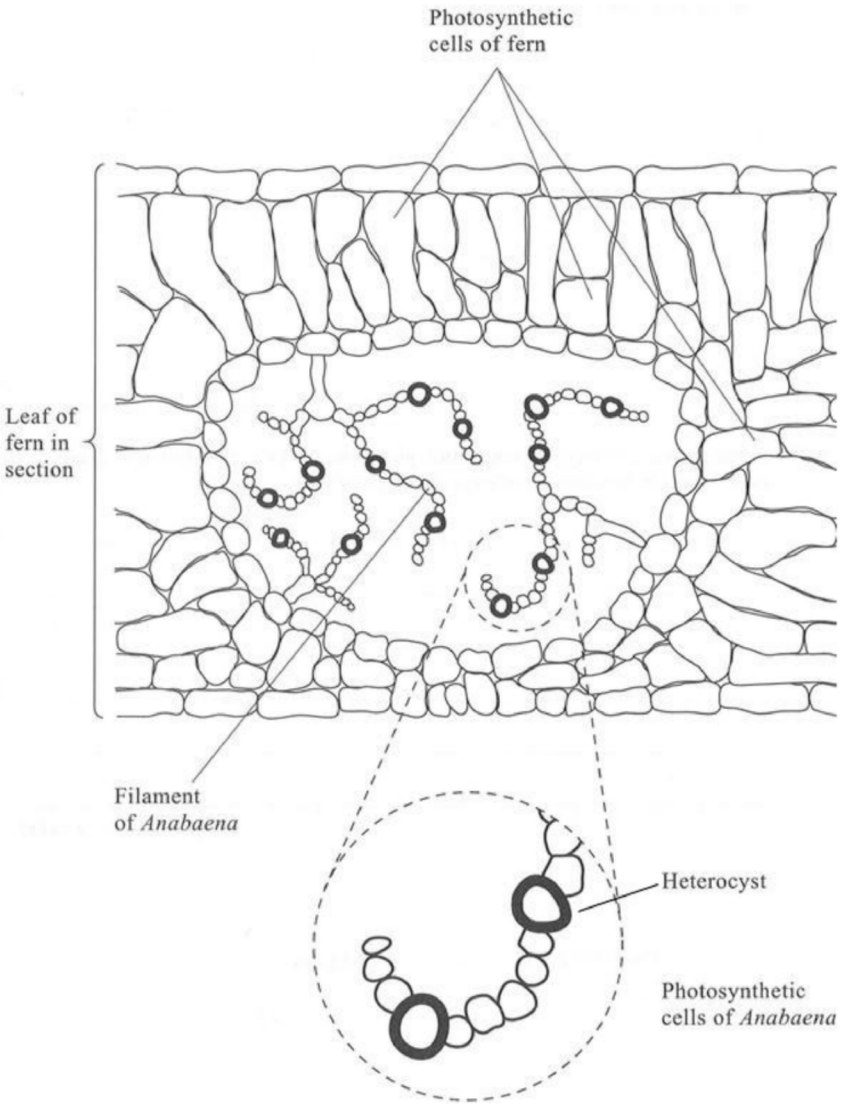
_____

_____

_____

(3)

(b) Anabaena is a prokaryote found inside the leaves of a small fern. Anabaena can produce ammonia from nitrogen (nitrogen fixation). This reaction only takes place in the anaerobic conditions found in cells called heterocysts. Heterocysts are thick-walled cells that do not contain chlorophyll. The drawing shows the relationship between *Anabaena* and the fern.



(i) Suggest how the features of the heterocysts improve the efficiency of the process of nitrogen fixation.

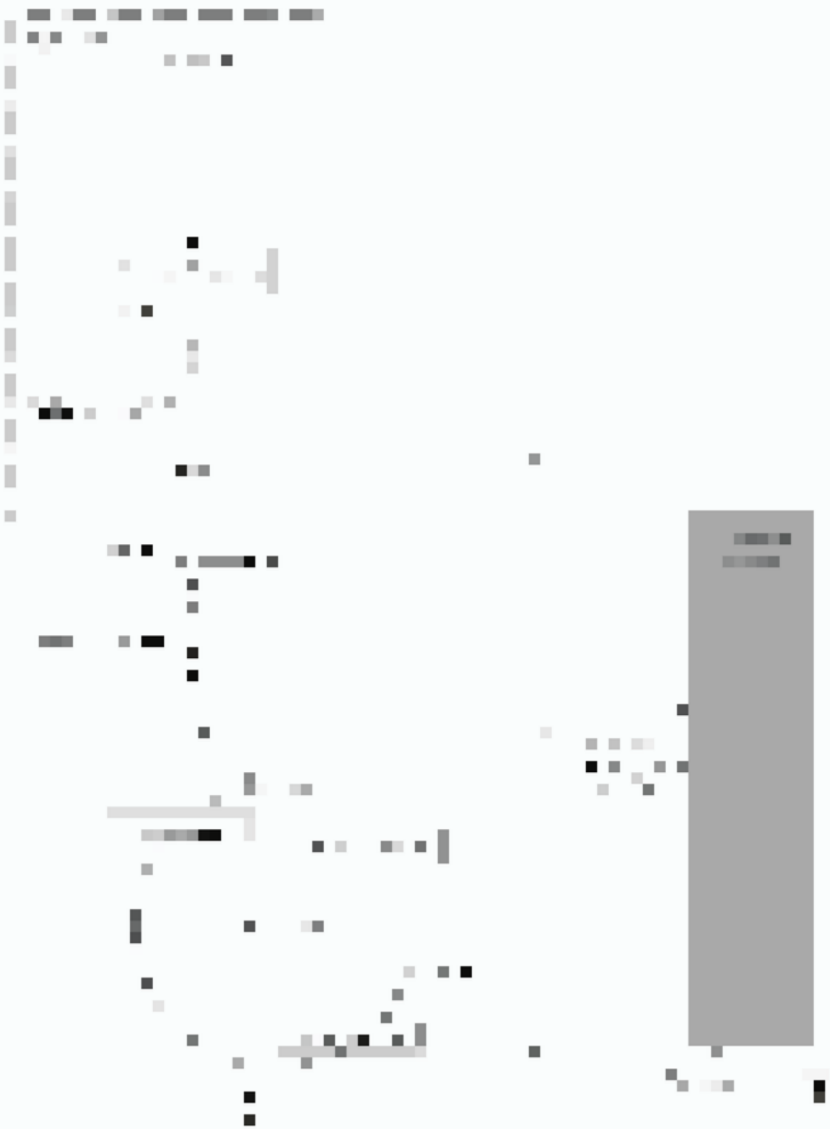
(3)

(ii) In China, the fern is cultivated and ploughed into fields to act as an organic fertiliser. Explain how ploughing the fern plants into the soil results in an improvement in the growth of the rice crop grown in these fields.

(5)

(Total 15 marks)

12 The diagram gives an outline of the process of aerobic respiration.



(a) Name substances **X**, **Y** and **Z**.

X _____

Y _____

Z _____

(3)

(b) Give the location of each of the following in a liver cell.

(i) Glycolysis _____

(ii) The Krebs cycle _____

(2)

(c) (i) Write the letter **A** on the diagram to show **one** step where ATP is used.

(ii) Write the letter **B** on the diagram at **two** steps where ATP is produced.

(3)

(d) Apart from respiration, give **three** uses of ATP in a liver cell.

1. _____

2. _____

3. _____

(3)

(e) Human skeletal muscle can respire both aerobically and anaerobically. Describe what happens to pyruvate in anaerobic conditions and explain why anaerobic respiration is advantageous to human skeletal muscle.

_____

_____

_____

_____

_____

_____

_____

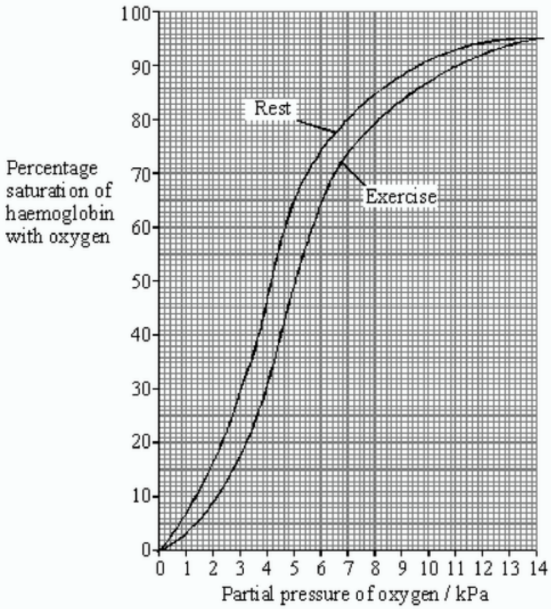
_____

(4)

(Total 15 marks)

13 The graph shows dissociation curves for human oxyhaemoglobin at rest and during exercise.

Table 1 gives information about conditions in the body at rest and during exercise.



	Rest	Exercise
Plasma pH	7.4	7.2
Blood temperature / °C	37.0	39.0
Alveolar partial pressure of oxygen / kPa	13.3	13.3
Tissue partial pressure of oxygen / kPa	5.0	4.0

Table 1

(a) What is meant by the term *partial pressure*?

_____

_____

(1)

(b) Use **Table 1** and the graph to calculate the difference in the percentage saturation of haemoglobin in the tissues between rest and exercise.

Answer _____ %

(1)

(c) Explain the differences between the figures shown in **Table 1** for rest and exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d) Explain the advantage of the difference in position of the dissociation curve during exercise.

_____

_____

_____

_____

(2)

Table 2 shows how the oxygen concentration in the blood going to and from a muscle changes from rest to heavy exercise.

		Oxygen concentration / cm^3 per 100 cm^3 blood	
		Blood in arteries	**Blood in veins**
At rest	**In solution**	0.3	0.2
	As oxyhaemoglobin	19.5	15.0
	Total oxygen	19.8	15.2
During heavy exercise	**In solution**	0.3	0.1
	As oxyhaemoglobin	20.9	5.3
	Total oxygen	21.2	5.4

Table 2

(e) By how many times is the volume of oxygen removed from the blood by the muscle in **Table 2** during heavy exercise greater than the volume removed at rest?

Show your working.

Answer _____ times

(2)

(f) Does enriching inspired air with oxygen have any effect on the amount of oxygen reaching the tissues? Support your answer with evidence from the graph and **Table 2**.

_____

_____

_____

_____

_____

_____

(3)

S (g) The change to the dissociation curve is one of a number of ways in which the total oxygen supplied to muscles is increased during exercise. Give **two** other ways in which the total oxygen supplied to muscles during exercise is increased.

1. _____

_____

2. _____

_____

(2)

(Total 15 marks)

14 (a) Pyruvate is formed in the breakdown of glucose during respiration. When there is sufficient oxygen, this pyruvate is fully broken down. Name **two** substances formed from the pyruvate.

1. _____

2. _____

(1)

(b) (i) If there is a shortage of oxygen in muscle cells during exercise, some pyruvate is converted into lactate. Explain why muscles become fatigued when insufficient oxygen is available.

_____

_____

_____

_____

(2)

(ii) Some of the lactate is oxidised to pyruvate by muscles when they are well-supplied with oxygen. Suggest an advantage of the lactate being oxidised in the muscles.

_____

_____

_____

_____

(2)

(Total 5 marks)

15 (a) The table contains some statements relating to biochemical processes in a plant cell. Complete the table with a tick if the statement is true or a cross if it is not true for each biochemical process.

Statement	Glycolysis	Krebs cycle	Light-dependent reaction of photosynthesis
NAD is reduced			
NADP is reduced			
ATP is produced			
ATP is required			

(4)

(b) An investigation was carried out into the production of ATP by mitochondria. ADP, phosphate, excess substrate and oxygen were added to a suspension of isolated mitochondria.

(i) Suggest the substrate used for this investigation.

_____

(1)

(ii) Explain why the concentration of oxygen and amount of ADP fell during the investigation.

_____

_____

_____

_____

(2)

(iii) A further investigation was carried out into the effect of three inhibitors, **A**, **B** and **C**, on the electron transport chain in these mitochondria. In each of three experiments, a different inhibitor was added. The table shows the state of the electron carriers, **W–Z**, after the addition of inhibitor.

Inhibitor added	Electron carrier			
	W	X	Y	Z
A	oxidised	reduced	reduced	oxidised
B	oxidised	oxidised	reduced	oxidised
C	reduced	reduced	reduced	oxidised

Give the order of the electron carriers in this electron transport chain. Explain your answer.

Order _____ _____ _____ _____

Explanation _____

_____

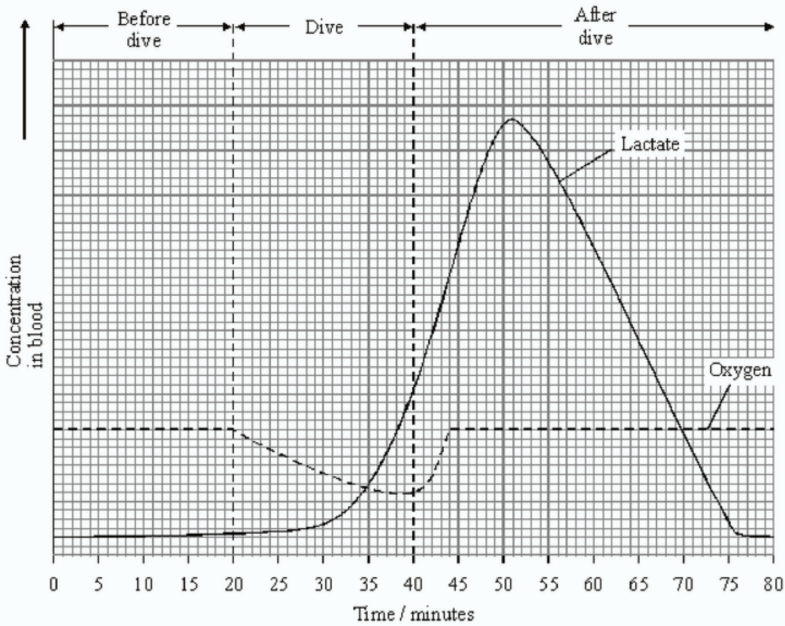
_____

(2)

(Total 9 marks)

16 Seals are aquatic mammals. They use lungs as organs of gas exchange so they do not breathe when they are under water during a dive.

The graph shows changes in oxygen and lactate concentration in the blood of a seal before, during and after a dive.



(a) The concentration of oxygen in the blood fell during the dive. Explain why.

_____

_____

(1)

(b) Use information in the graph to calculate how long it took from the end of the dive for the seal to recover fully.

Answer _____ minutes

(1)

(c) Explain what causes the concentration of blood lactate to fall after a dive.

_____

_____

_____

_____

(2)

(d) Reducing the volume of blood pumped out by the heart reduces the rate of blood flow to the diaphragm muscles.

(i) Give **one** other way in which blood flow into the diaphragm muscles may be reduced.

_____

_____

(1)

(ii) During a dive, blood flow to the diaphragm muscles of a seal is reduced. Suggest the advantage to the seal of maintaining some blood supply to the diaphragm muscles during a dive.

_____

_____

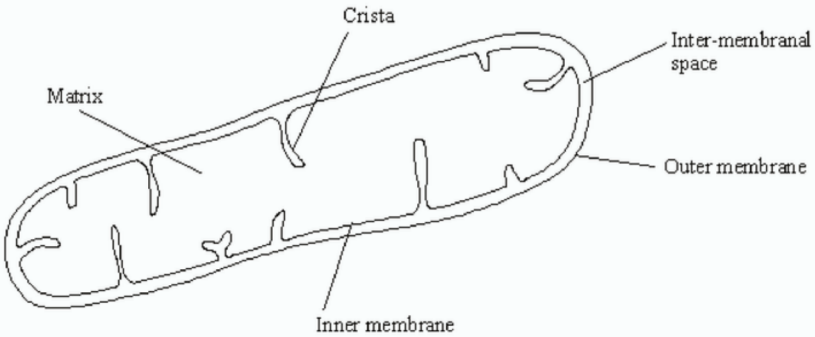
_____

_____

(2)

(Total 7 marks)

17 The diagram shows the structure of a mitochondrion.



(a) In which part of the mitochondrion does the Krebs cycle take place?

_____

(1)

(b) Name **two** substances for which there would be net movement into the mitochondrion.

1. _____

2. _____

(2)

(c) The mitochondria in muscles contain many cristae. Explain the advantage of this.

_____

_____

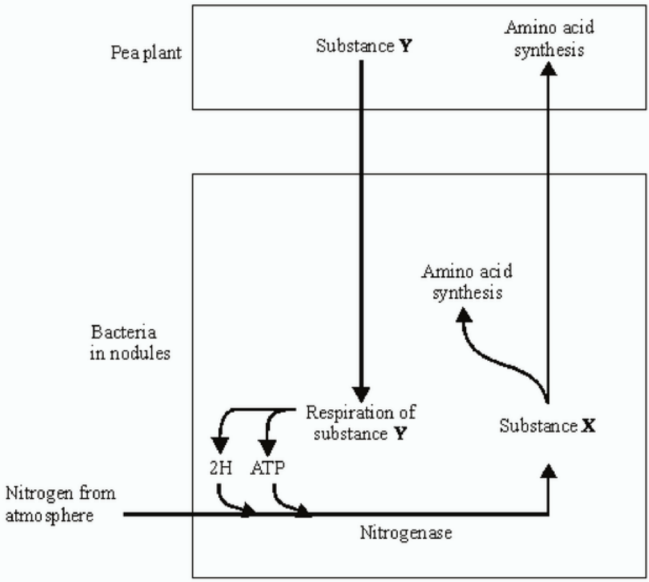
_____

_____

(2)

(Total 5 marks)

18 Pea plants are leguminous and have nodules on their roots which contain bacteria that are able to fix nitrogen. The diagram shows some of the processes involved in nitrogen fixation by these bacteria.



(a) Name

(i) substance **X**;

_____

(1)

(ii) substance **Y**.

_____

(1)

S (b) Pea plants respire aerobically, producing ATP which can be used for amino acid synthesis. Describe the role of oxygen in aerobic respiration.

_____

_____

_____

_____

(2)

S (c) The bacteria respire anaerobically. This produces hydrogen and ATP used in nitrogen fixation. The hydrogen comes from reduced NAD. Explain how the regeneration of NAD in this way allows ATP production to continue.

(2)

S (d) The enzyme nitrogenase is specific to the reaction shown. Explain how **one** feature of the enzyme would contribute to this specificity.

Feature

Explanation

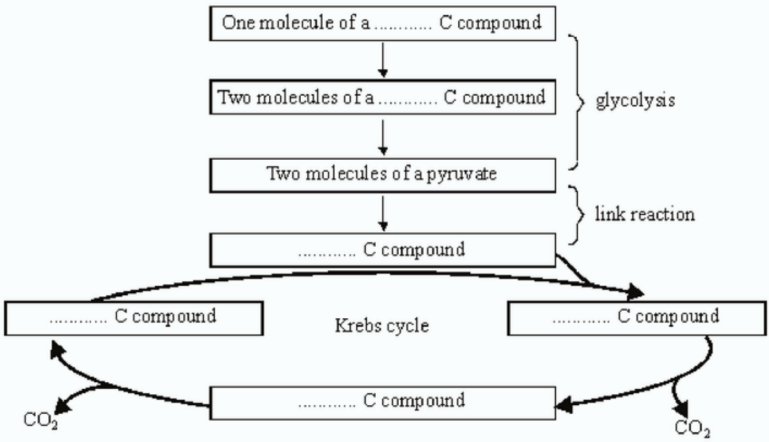
(2)

S (e) Sodium ions act as a non-competitive inhibitor of the enzyme nitrogenase. Explain how the presence of a non-competitive inhibitor can alter the rate of the reaction catalysed by nitrogenase.

(3)

(Total 11 marks)

19 The boxes in the diagram represent substances in glycolysis, the link reaction and the Krebs cycle.



(a) Complete the diagram to show the number of carbon atoms present in **one** molecule of each compound.

(2)

(b) Other substances are produced in the Krebs cycle in addition to the carbon compounds shown in the diagram. Name **three** of these other products.

1. _____

2. _____

3. _____

(3)

(Total 5 marks)

20 **S** In an investigation, the effects of caffeine on performance during exercise were measured. One group of athletes (**A**) was given a drink of decaffeinated coffee. Another group (**B**) was given a drink of decaffeinated coffee with caffeine added. One hour later the athletes started riding an exercise bike and continued until too exhausted to carry on. Three days later the same athletes repeated the experiment, with the drinks exchanged.

(a) (i) The researchers added caffeine to decaffeinated coffee. Explain why they did not just use normal coffee.

_____

_____

(1)

(ii) The performance of the athletes might have been influenced by how they expected the caffeine to affect them. How could the researchers avoid this possibility?

_____

_____

(1)

During the exercise the concentrations of glycerol and fatty acids in the blood plasma were measured. The results are shown in the table.

Drink	Mean time to exhaustion /minutes	Mean concentration of blood glycerol/ mmol dm^{-3}	Mean concentration of blood fatty acids/ mmol dm^{-3}
With caffeine	90.2	0.20	0.53
Without caffeine	75.5	0.09	0.31

(b) (i) Describe the effect of caffeine on exercise performance.

_____

_____

(1)

(ii) Suggest **one** explanation for the higher glycerol and fatty acid concentrations in the blood plasma of the athletes after they were given caffeine.

_____

_____

_____

_____

(2)

(c) The researchers measured the volumes of carbon dioxide exhaled and oxygen inhaled during the exercise. From the results they calculated the respiratory quotient (RQ), using the formula

$$RQ = \frac{\text{volume of carbon dioxide exhaled per minute}}{\text{volume of oxygen inhaled per minute}}$$

When a person is respiring carbohydrate only, RQ = 1.0

When a person is respiring fatty acids only, RQ = 0.7

(i) The basic equation for the respiration of glucose is

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Explain why the RQ for glucose is 1.0.

_____

_____

_____

_____

(2)

(ii) The researchers found that, when the athletes were given the drink containing caffeine, their mean RQ was 0.85. When given the drink without caffeine their mean RQ was 0.92.

The researchers concluded that when the athletes had caffeine they used glycogen more slowly than when they did not have caffeine, and that the store of glycogen in their muscles was used up less quickly during the exercise.

Explain the evidence from the information above and from the table which supports these conclusions.

_____

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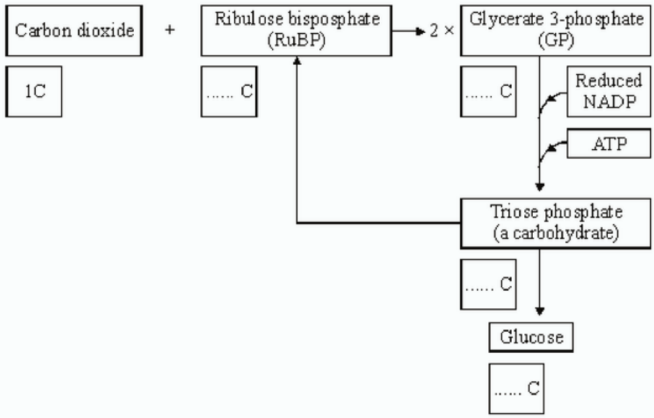
_____

(3)

(Total 10 marks)

21 The diagram shows a summary of the light-independent reaction of photosynthesis.



(a) (i) Complete the boxes to show the number of carbon atoms in the molecules.

(2)

(ii) In which part of a chloroplast does the light-independent reaction occur?

_____

(1)

(iii) Which process is the source of the ATP used in the conversion of glycerate 3-phosphate (GP) to triose phosphate?

_____

(1)

(iv) What proportion of triose phosphate molecules is converted to ribulose bisphosphate (RuBP)?

_____

(1)

(b) Lowering the temperature has very little effect on the light-dependent reaction, but it slows down the light-independent reaction. Explain why the light-independent reaction slows down at low temperatures.

_____

_____

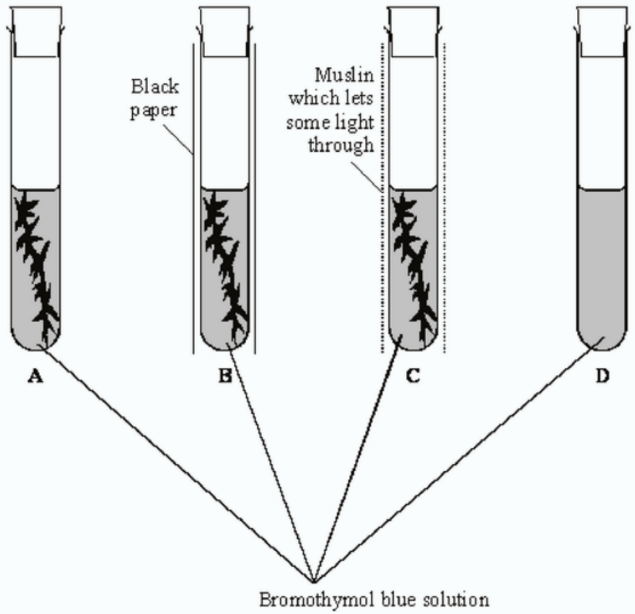
_____

_____

(2)

22 Gas exchange in an aquatic plant was investigated by placing shoots in tubes containing bromothymol blue indicator solution. Bromothymol blue indicator is yellow below pH 6, green between pH 6.1 and 7.5, and blue at pH 7.6 and above. Into each of four tubes, **A**, **B**, **C** and **D**, 10 cm^3 of bromothymol blue solution were placed. Each tube was closed with a bung and left for 10 minutes. Similar-sized shoots of an aquatic plant were then placed into each of tubes **A**, **B** and **C**. The tubes were treated as shown in the diagram.

They were then placed at equal distances from a 60 watt lamp and left for one hour.



The table shows the initial and final colours of the indicator in the four tubes.

Tube	Treatment	Initial colour of indicator	Colour of indicator after one hour
A	Uncovered	Green	Blue
B	Covered with black paper	Green	Yellow
C	Covered with muslin	Green	Green
D	Uncovered	Green	Green

(a) Explain the results for

tube **A**;

_____

_____

_____

_____

tube **B**;

_____

_____

_____

_____

tube **C**.

_____

_____

_____

_____

(4)

(b) (i) Explain how the results from tube **D** help to confirm that the explanations for the other tubes are valid.

_____

_____

(1)

(ii) Explain why all the tubes were placed the same distance from the lamp.

_____

_____

(1)

(Total 6 marks)

23 (a) Mitochondria in muscle cells have more cristae than mitochondria in skin cells. Explain the advantage of mitochondria in muscle cells having more cristae.

_____

_____

_____

_____

(2)

(b) Substance **X** enters the mitochondrion from the cytoplasm. Each molecule of substance **X** has three carbon atoms.

(i) Name substance **X**.

_____

(1)

(ii) In the link reaction substance **X** is converted to a substance with molecules effectively containing only two carbon atoms. Describe what happens in this process.

_____

_____

_____

_____

(2)

(c) The Krebs cycle, which takes place in the matrix, releases hydrogen ions. These hydrogen ions provide a source of energy for the synthesis of ATP, using coenzymes and carrier proteins in the inner membrane of the mitochondrion.

Describe the roles of the coenzymes and carrier proteins in the synthesis of ATP.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

24 (a) In respiration in cells,

(i) where does glycolysis take place

_____

(1)

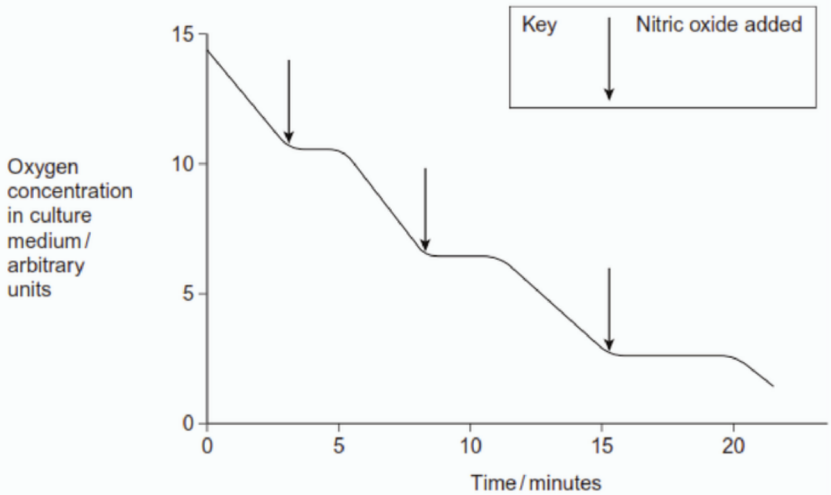
(ii) where, exactly, is the electron transfer chain found?

_____

(1)

(b) Scientists kept kidney cells in a liquid culture. They investigated the effect of the gas nitric oxide on oxygen consumption by these cells. They recorded the oxygen concentration in the culture medium over a period of time. At intervals they added a small volume of nitric oxide to the culture medium. Nitric oxide affects the functioning of a protein in the electron transport chain.

The graph shows their results.



Explain the effect of nitric oxide.

_____

_____

_____

_____

_____

_____

(Extra space) _____

_____

_____

(3)

(Total 5 marks)

25 (a) During respiration where, exactly, in a cell does each of the following occur?

(i) Glycolysis

_____

(1)

(ii) Electron transfer chain

_____

(1)

(b) Without oxygen, less ATP is produced by respiration. Explain why.

_____

_____

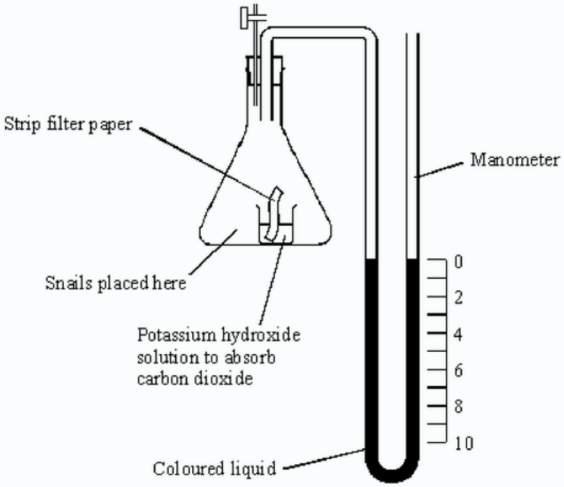
_____

_____

(2)

(Total 4 marks)

26 **S** The diagram shows apparatus used to measure the oxygen uptake of snails that live on the seashore. The apparatus was kept at a constant temperature.



(a) (i) Explain the purpose of the strip of filter paper in the potassium hydroxide solution.

_____

_____

(1)

(ii) The level of liquid in the right-hand side of the manometer went down during the experiment. Explain why.

_____

_____

_____

_____

(2)

(iii) What measurements are needed to calculate the rate of oxygen uptake by the snails in $mm^3\ g^{-1}\ h^{-1}$?

_____

_____

_____

(b) Two experiments were carried out using the apparatus shown in the diagram.

1 The oxygen uptake of batches of 10 seashore snails kept in moist air was measured at temperatures between 5 °C and 35 °C.

2 Experiment 1 was repeated but with batches of 10 seashore snails covered by aerated seawater.

The experiments were repeated several times and means and standard deviations calculated. The results are shown in the table. The values given are means plus or minus one standard deviation.

Temperature / °C	Oxygen uptake of snails kept in moist air / $mm^3\ g^{-1}\ h^{-1}$	Oxygen uptake of snails kept in seawater / $mm^3\ g^{-1}\ h^{-1}$
5	35 ± 2	28 ± 8
10	34 ± 6	32 ± 3
15	36 ± 3	35 ± 3
20	86 ± 8	52 ± 10
25	141 ± 13	96 ± 15
30	132 ± 14	108 ± 9
35	120 ± 16	79 ± 21

(i) Describe **one** similarity and **one** difference between the pattern of mean oxygen uptake of the snails kept in moist air and those covered by seawater.

_____

_____

_____

_____

(2)

(ii) Explain why valid conclusions cannot be drawn about the trends in oxygen uptake at temperatures of 25 °C and above.

_____

_____

_____

_____

(2)

(Total 10 marks)

27 When one mole of glucose is burned, 2800 kJ of energy are released. However, when one mole of glucose is respired aerobically, only 40% of the energy released is incorporated into ATP. Each mole of glucose respired aerobically produces 38 moles of ATP.

(a) (i) Calculate how much energy is incorporated into each mole of ATP. Show your working.

Answer _____ kJ

(2)

(ii) When glucose is respired what happens to the energy which is **not** incorporated into ATP?

_____

(1)

(b) (i) When one mole of glucose is respired anaerobically, only 2 moles of ATP are produced. Explain why less energy is released in anaerobic respiration.

_____

_____

(1)

(ii) At the end of a sprint race, a runner continues to breathe rapidly for some time. Explain the advantage of this.

_____

_____

_____

_____

(2)

(Total 6 marks)