(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.

_____

_____

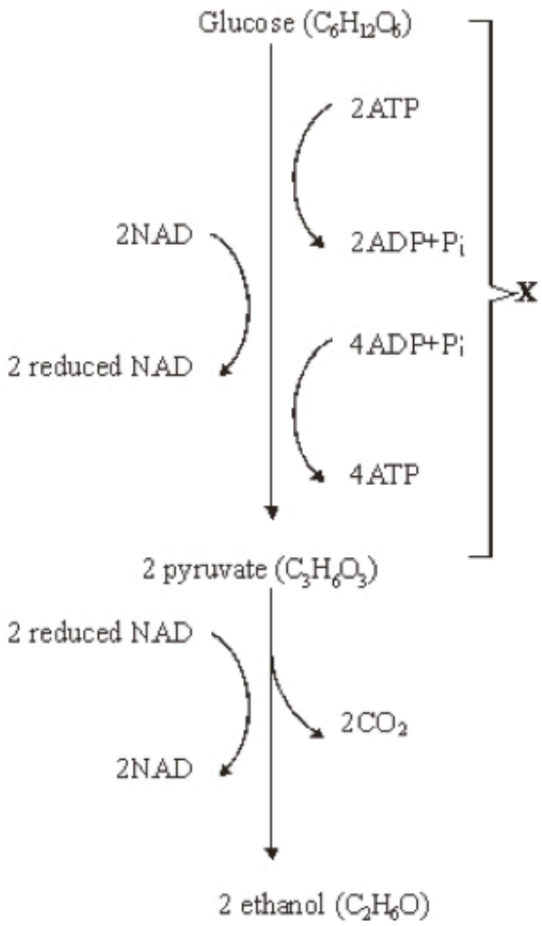
_____

_____

(2)

(Total 5 marks)

(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.

_____

_____

_____

_____

(2)

(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. _____

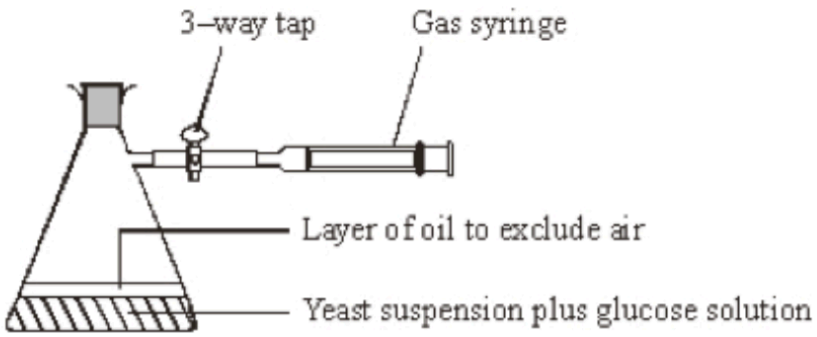
_____

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)

(a) CO_2, water, ATP, reduced NAD / FAD
(accept creatine phosphate)(any 2 - one tick)

1

(b) (i) build up / increased concentration of lactate lowers pH / increases H^+ / increases acidity
enzymes / named protein inhibited*(not denatured)*

2

(ii) lactate / pyruvate is an energy source
muscles have increased / immediate energy or ATP supply
(accept lactate replenishes glycogen or glucose)
restores pH levels

2 max
[5]

(a) (i) glycolysis

1

(ii) oxygen removed from pyruvate / reduced NAD is oxidised / donates hydrogen / donates electrons

1

(iii) allows NAD to be recycled / re-formed
so that glycolysis / described / candidates answer to (i) can proceed / so that (more) glucose can be converted to pyruvate / so that process X can continue

2

(b) (i) ATP formed / used
pyruvate formed / reduced
NAD / reduced NAD
glycolysis involved / two stage process

2 max

(ii) ethanol / alcohol formed by yeast, lactate (*allow lactic acid)*
by muscle cell CO_2 released by yeast but not by muscle cell
(note: need both parts of the comparison for the mark)

2

(c) (i) allows anomalies to be identified / increases reliability (of means / averages / results)
allows use of statistical test

2

(ii) = 31.8 / 31.76 / 31.77
(units not required)
÷ (5 × 60) = 0.106 / 0.11 / 0.1
(correct answer scores two marks, however derived.)
(correct mean volume (31.8 cm^3) however derived scores 1 mark)

2

(iii) Volume(s) less / no gas evolved
So (volume) CO_2 evolved = (volume of) O_2 taken in

3
[15]