Human Biology Higher Homework: Topic Human Cells

Sub-topic3: Cell Metabolism

1. During which of the following chemical conversions is A T P produced?

A Amino acids ➔ protein

B Glucose ➔ pyruvic acid

C Haemoglobin ➔oxyhaemoglobin

D Nucleotides ➔mRNA

2. The following statements relate to respiration and the mitochondrion.

1 Glycolysis takes place in the mitochondrion.
2 The mitochondrion has two membranes.
3 The rate of respiration is affected by temperature.

Which of the above statements are correct?

A. 1 and 2
B. 1 and 3
C. 2 and 3
D. All of them

3. The anaerobic breakdown of glucose splits from the aerobic pathway of respiration.

A. after the formation of pyruvic acid

B. after the formation of acetyl CoA

C. after the formation of citric acid

D. at the start of glycolysis.

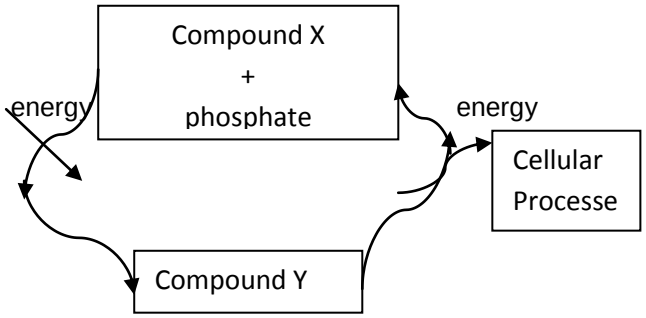
4. In respiration, the products of the cytochrome system are

A. hydrogen and carbon dioxide

B. water and ATP

C. oxygen and ADP
D. pyruvic acid and water.

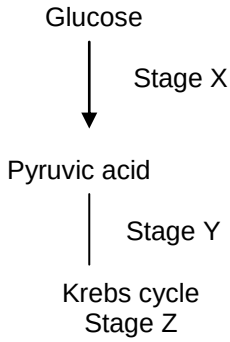
5. The diagram below shows energy transfer within a cell.



Which line in the table below identified correctly compounds X and Y?

	X	Y
A	glucose	ATP
B	glucose	ADP
C	ADP	ATP
D	ATP	glucose

6. The following chart shows stages in the complete breakdown of glucose in aerobic respiration.



At which stage or stages is hydrogen released to be picked up by hydrogen acceptors?

A. Stages X, Y and Z
B. Stages X and Y only
C. Stages Y and Z only
D. Stage Z only

7. In respiration, the sequence of reactions resulting in the conversion of glucose to pyruvic acid is called

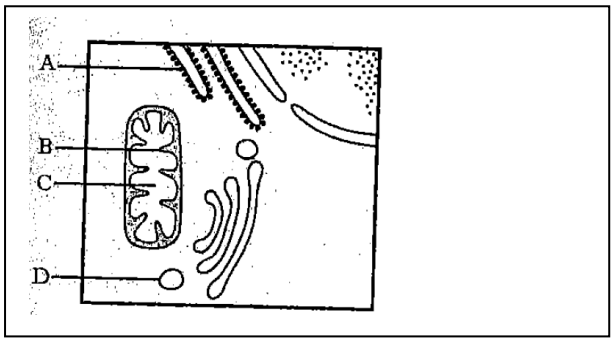
A. the cytochrome system

B. the TCA cycle

C. the Krebs cycle

D. glycolysis.

8. The diagram shows part of a liver cell with four parts labelled. In which part is most ATP produced?



9. Glycolysis takes place in the

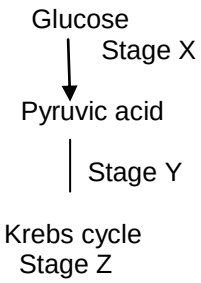
A. nucleus

B. cristae of mitochondria

C. matrix of mitochondria

D. cytoplasm.

10. The following diagram represents stages in the complete breakdown of glucose in aerobic respiration.



At which stage, or stages, is carbon dioxide released?

A. Stages X and Z
B. Stages X and Y
C. Stages Y and Z
D. Stage Z only.

11. In respiration, the sequence of reactions resulting in the conversion of glucose to pyruvic is called

A. the Krebs cycle

B. the citric acid cycle

C. glycolysis

D. the cytochrome chain.

12. Which of the following is an insoluble polysaccharide?

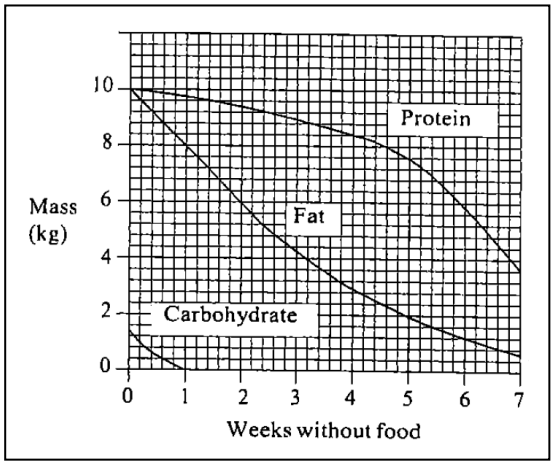
A. Glycogen

B. Glucose

C. Sucrose

D. Maltose

13. The graph below shows changes which occur in the masses of protein, fat and carbohydrate in a person's body during seven weeks without food.

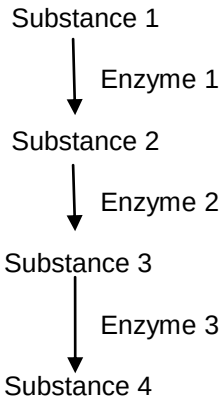


Weeks without food

The person's starting weight was 60kg. Predict their weight after two weeks without food.

A. 57kg
B. 54kg
C. 50kg
D. 43kg

14. The diagram below shows a metabolic pathway that is controlled by end product inhibition.



For Substance 4 to bring about end product inhibition, with which of the following would it interact.

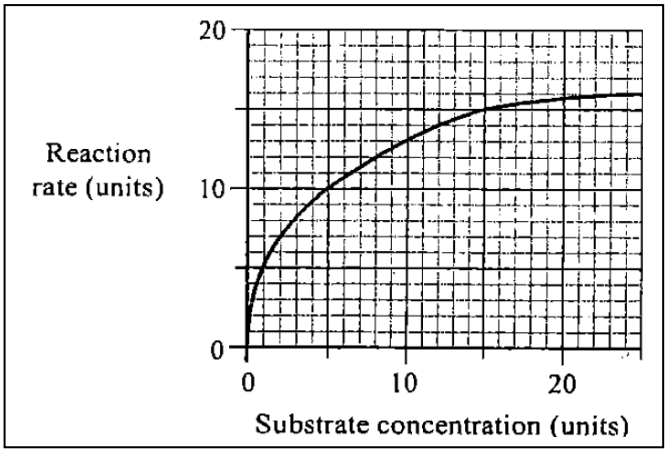
A. Enzyme 1

B. Enzyme 3

C. Substance 1

D. Substance 3

15. The graph shows the effect of substrate concentration on the rate of an enzyme-catalysed reaction.



At what substrate concentration is the reaction rate equal to 75% of the maximum rate?

A. 6 units
B. 8 units
C. 12 units
D. 18 units

16. The key below can be used to identify carbohydrates.

1. Soluble ……2
   Insoluble ……..glycogen

2. Benedict's test positive …….3
   Benedict's test negative ……sucrose

3. Barfoed's test positive ……..4
   Barfoed's test negative ……..lactose

4. Clinistix test positive ……..glucose
   Clinistix test negative …….fructose

Which line in the table of results below is **not** in agreement with the information contained in the key?

	Carbohydrate	Benedict's test	Barfoed's test	Clinistix test
A	lactose	positive	negative	not tested
B	glucose	positive	negative	positive
C	fructose	positive	positive	negative
D	sucrose	negative	not tested	not tested

17. Lysosomes are abundant in

A enzyme secreting cells

B muscle cells

C cells involved in protein synthesis

D phagocytic cells

18. The Golgi apparatus is involved in the packing of

A. ribosomes

B. monosaccharides

C. RNA

D. enzymes.

19. Which of the following often act as a co-enzyme?

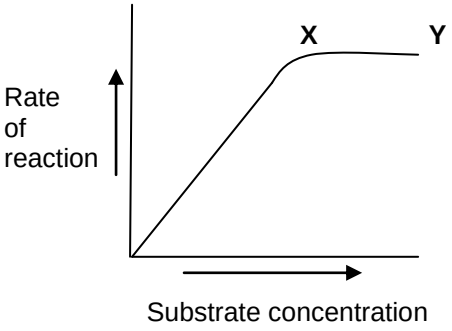
A. Lipids

B. Polysaccharides

C. Hormones

D. Vitamins

20. The graph shows the effect of substrate concentration on the rate of an enzyme-controlled reaction.



The graph levels out between points X and Y because the

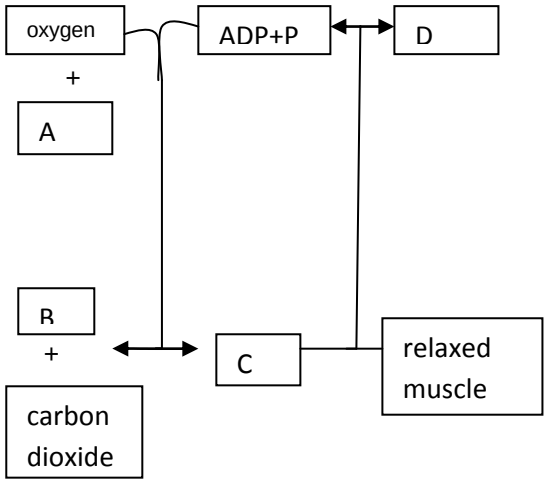
A. enzyme is denatured

B. active sites are saturated with substrate

C. enzyme is inhibited

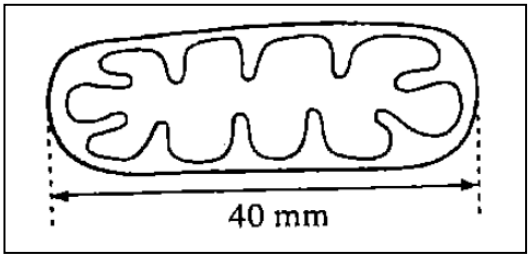
D. enzyme is activated.

21. The diagram below represents stages in tissue respiration.



Which box represents ATP?

22. The cell organelle shown below is magnified ten thousand times.



What is the actual size of the organelle?

A. 1.04µm
B. 0.4 µm
C. 4 µm
D. 40 µm

23. A piece of muscle was cut into three strips X, Y and Z and treated as described in the table.

Their final lengths were then measured.

Muscle strip	Solution added to muscle	Muscle length (mm) Start	Muscle length (mm) 10 minutes
X	1 % glucose	50	50
Y	1 % ATP	50	45
Z	1% ATP boiled and cooled	50	46

From the data it may be deducted that

A. ATP is not an enzyme

B. muscles contain many mitochondria

C. muscles synthesise ATP in the absence of glucose

D. muscles do not use glucose as a source of energy.

24. Which line in the table has pairs of statements which are true with regard to aerobic respiration and anaerobic respiration in human muscle tissue?

	Aerobic respiration	Anaerobic respiration
A	There is a net gain of ATP	Carbon dioxide is not produced
B	There is a net gain of ATP	Oxygen is used up
C	Carbon dioxide is evolved	There is a net loss of ATP
D	Lactic acid is formed	Ethanol is formed

25. The following table gives information on the control of metabolic pathways using inhibitors.

Which line in the table is CORRECT?

	Type of inhibitor		
	Competitive	**Non-competitive**	**Feedback inhibition**
A.	Binds to active site of the enzyme	Changes shape of active site of enzyme	End product binds to an enzyme that catalyses a reaction early in the pathway
B.	End product binds to an enzyme that catalyses a reaction early in the pathway	Changes shape of active site of enzyme	Binds to active site of the enzyme
C.	Changes shape of active site of enzyme	Binds to active site of the enzyme	End product binds to an enzyme that catalyses a reaction early in the pathway
D.	Binds to active site of the enzyme	End product binds to an enzyme that catalyses a reaction early in the pathway	Changes shape of active site of enzyme

26. Which of the stages in aerobic respiration produces the most ATP?

A. Glycolysis B. Citric Acid C. Krebs Cycle D. Electron Transport (Cytochrome system)

27. Which of the following is a coenzyme found in respiration?

A. FAD B. ATP C. NADP D. phosphofructokinases

28. Which of the following statements about the role of dehydrogenase enzyme in respiration is TRUE?

A. Dehydrogenase enzymes remove oxygen ions from a substrate

B. Dehydrogenase enzymes add hydrogen ions to a substrate

C. Dehydrogenase enzymes remove hydrogen ions from a substrate

D. Dehydrogenase enzymes add oxygen ions to a substrate

29. Which of the following statements is CORRECT?

A. Slow twitch muscle fibres are good for long distance running because they have fewer mitochondria and greater blood supply than fast twitch muscle fibres.

B. Slow twitch muscle fibres are good for long distance running because they have more mitochondria and lesser blood supply than fast twitch muscle fibres.

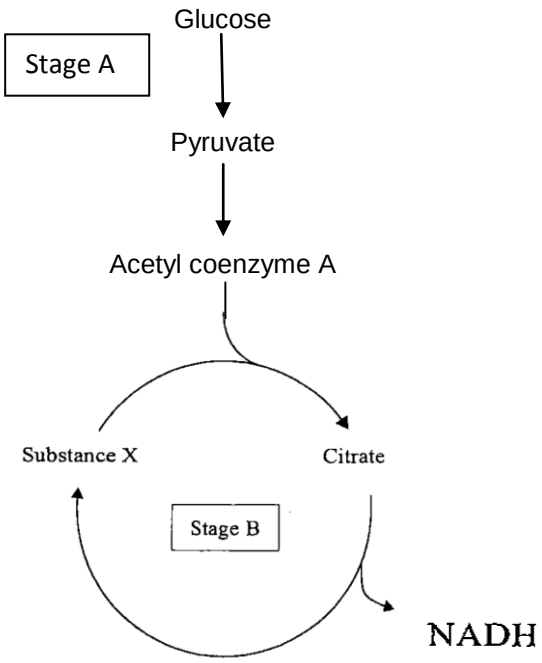
C. Slow twitch muscle fibres are good for long distance running because they have more mitochondria and greater blood supply than fast twitch muscle fibres.

D. Slow twitch muscle fibres are good for sprinting because they have more mitochondria and greater blood supply than fast twitch muscle fibres.

Do not write in this margin

Marks

30. The diagram below shows two stages of respiration.



(a) (i) Identify stages A and B.

Stage A _____

Stage B _____

(ii) Name Substance X.

_____ **1**

30 Continued **Marks**

(b) During Stage A, glucose is converted to pyruvate.

Name the molecule that provides phosphate for this conversion.

_____ **1**

(c) The conversion of citrate to substance X in Stage B involves several reactions.

Name **two** molecules, apart from NADH, which are produced during these reactions.

1. _____

2. _____ **1**

(d) Phosphofructokinase is an enzyme involved in Stage A.

The presence of excess citrate inhibits this enzyme.

Explain why this is important in the conservation of resources in the cell.

_____

_____ **1**

(e) N A D H is also produced during Stage A.

Explain the role of N A D H when cells do not get sufficient oxygen for aerobic respiration.

_____

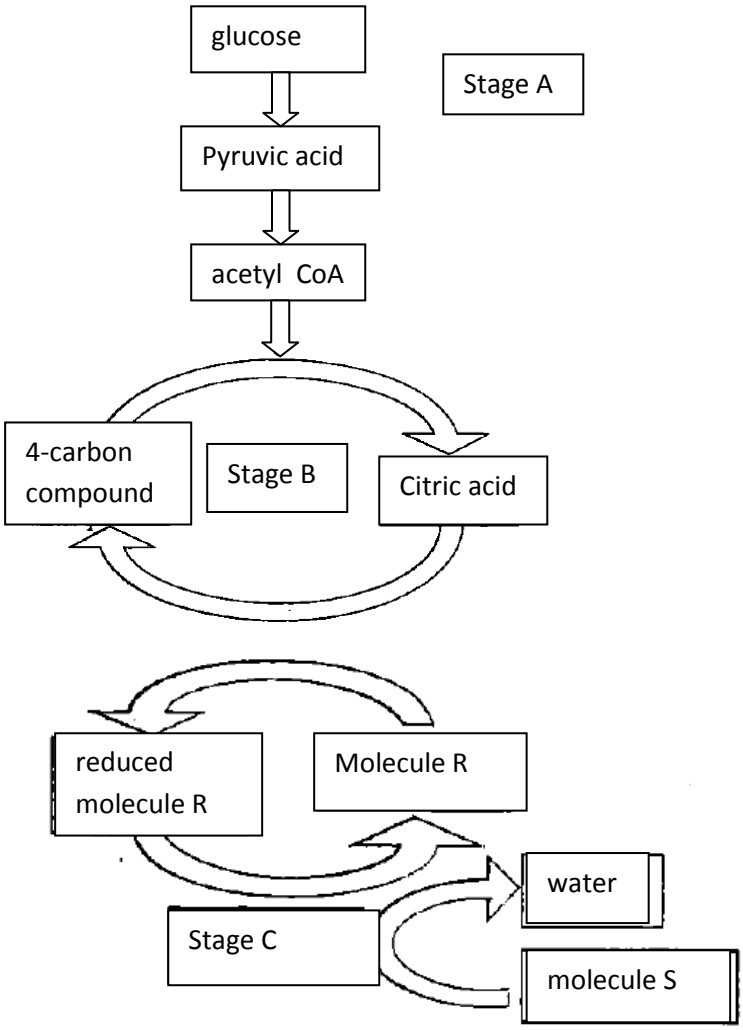
_____

_____

_____ **2**

31. The diagram below shows some of the reactions which occur during aerobic respiration.

Marks



(a) Complete the table by naming stages A, B and C and indicating their exact location within cell.

Stage	Name	Location
A		
B		
C		

3

(b) A glucose molecule contains 6 carbon atoms
How may carbon atoms are found in the flowing molecules?

Pyruvic acid _____

Citric acid _____ **1**

1. Continued) **Marks**

(c) Complete the following sentences by naming molecules R and S and describing their function with respect to stage C.

R is _____and its function is _____

_____

_____

S is _____and its function is _____

_____

_____ **2**

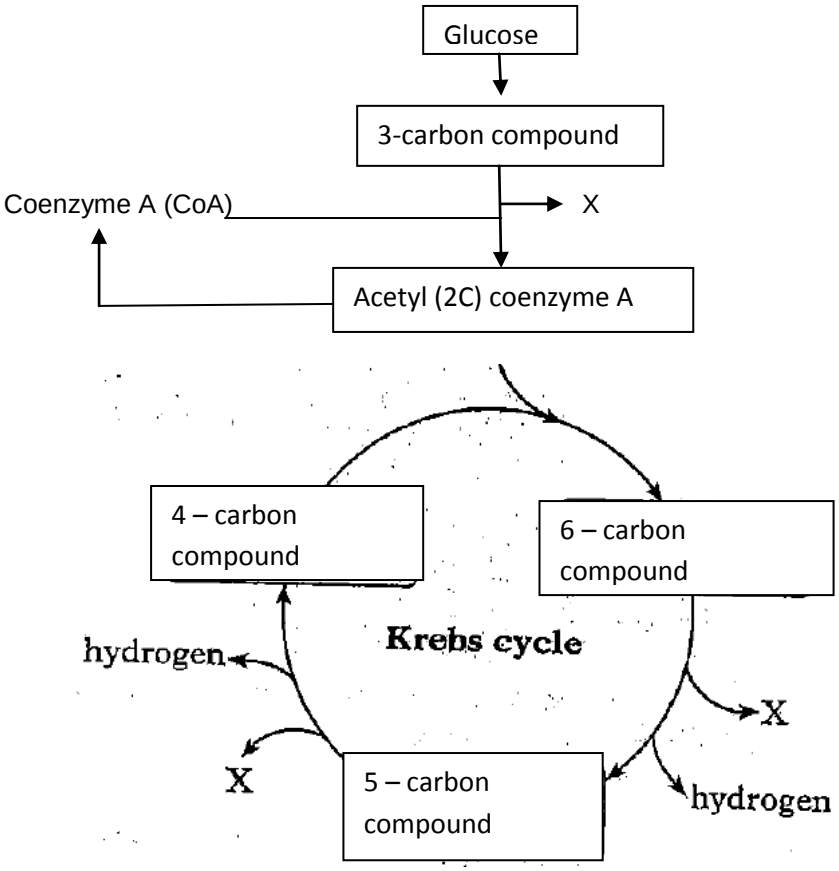
(d) Under normal circumstances carbohydrate is the main respiratory substrate.

In each of the following extreme situations, state the alternative respiratory substrate and explain why the body has to use it.

Situation	Respiratory substrate	Explanation
Prolonged starvation		
Towards the end of a marathon race		

2

32 ……..stages in the chemistry of respiration in a cell which is respiring aerobically.



(a) Name the 3-carbon compound and the 6-carbon compound.

3C _____

6C _____ **2**

(b) Draw a line across the diagram to indicate where this series of reactions would stop if oxygen were not available. **1**

(c) State the precise location of the Krebs cycle within the cell

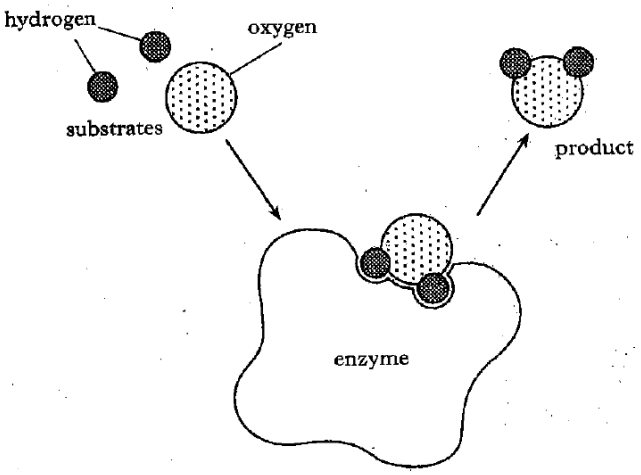
_____ **1**

(d) Complete the table below to name product X and to describe what happens to each of the products.

Product	Fate of product
X _____	
Hydrogen	

33

33 The diagram below represents a reaction catalysed by an enzyme in the cytochrome system.



(a) (i) What name is given to the part of the enzyme where this reaction occurs?

_____ **1**

(ii) In which organelle would this reaction take place?

_____ **1**

(iii) Name the product of this reaction.

_____ **1**

(b) Cyanide is a poison which inhibits this enzyme.
Suggest how cyanide is able to do this.

_____

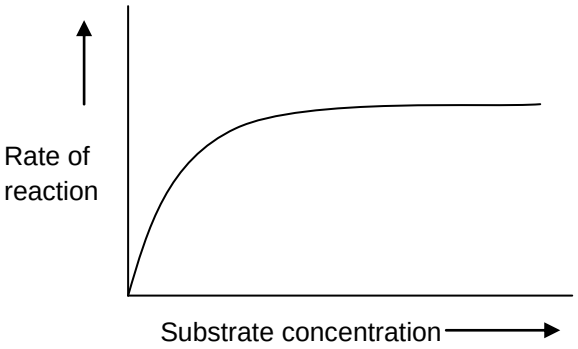
_____ **1**

(c) Why do many enzyme-catalysed reactions require the presence of vitamins or Minerals?

_____ **1**

33. (Continued)

(d) The graph shows the effect of increasing substrate concentration on the rate of this reaction.



(i) Explain why the graph levels out at high substrate concentration.

_____

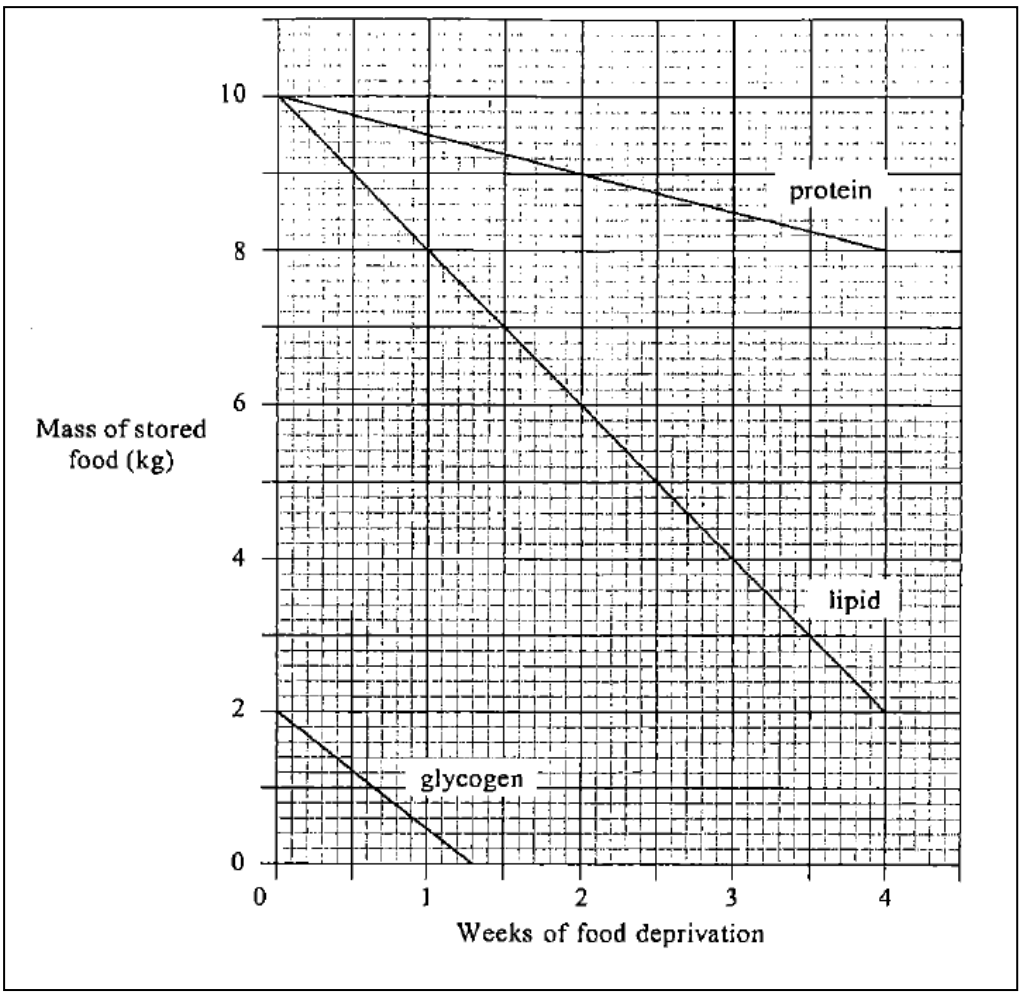
_____ **1**

(ii) Assuming that the enzyme is operating at its optimum pH and temperature, suggest how the rate of reaction could be increased at high substrate concentrations.

_____

_____ **1**

34. The graph below shows the changes which occur in a body's food stores during four weeks of food deprivation.



Which of the following conclusions can be drawn from the graph?

A The glycogen food store decreases at the fastest rate during week one.

B Between weeks three and four the body gains most energy from protein.

C Each food store decreases at a constant rate during week one.

D Between weeks one and four the body only gains energy from lipid and protein.

34B. Which of the following equations describes correctly the role of creatine phosphate?

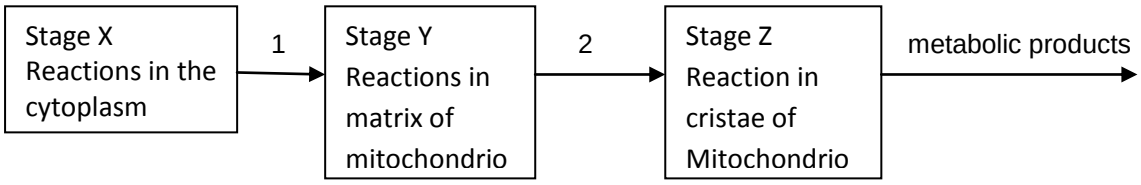
A ADP + phosphate + creatine ⟶ creatine phosphate + ATP

B creatine phosphate + ADP ⟶ ATP + creatine

C creatine phosphate + ATP ⟶ ADP + phosphate + creatine

D ATP + phosphate ⟶ creatine phosphate + ADP

35. The diagram below shows three stages that occur during aerobic respiration.



(a) Name each stage.

X _____

Y _____

Z _____

(b) (i) Arrows 1 and 2 represent the transfer of molecules from one stage to another. Complete the table to identify these molecules.

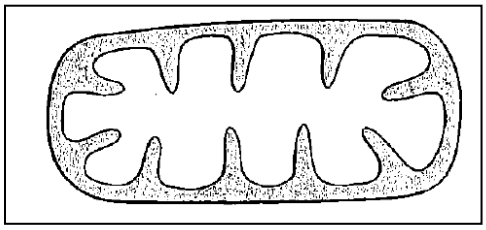
Arrow	Name of molecule
1	
2	

2

(ii) Name the **two** metabolic products of stage Z.

_____ and _____ 1

(c) The diagram below shows a mitochondrion from a skin cell.



Describe how the structure of mitochondrion from an active muscle cell would differ from the one shown. Give a reason for your answer.

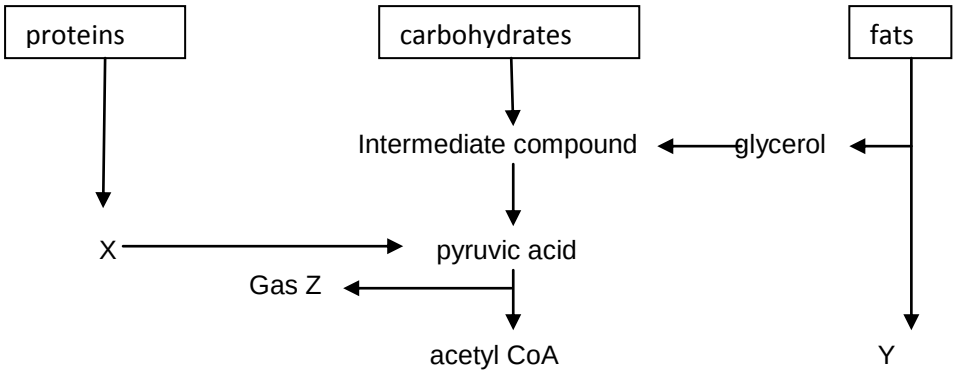
Structure difference _____

_____ 1

Reason _____

_____ 1

36. The diagram below shows the metabolism of three energy sources in a cell.



(a) Name X, Y and Z

X _____

Y _____

Z _____ 2

(b) What term describes the breakdown of carbohydrate into pyruvic acid during respiration?

_____ 1

(c) Describe what happens to acetyl CoA after it enters the Krebs Cycle.

_____

_____ 1

(d) Under what circumstances would the body gain most of its energy from proteins?

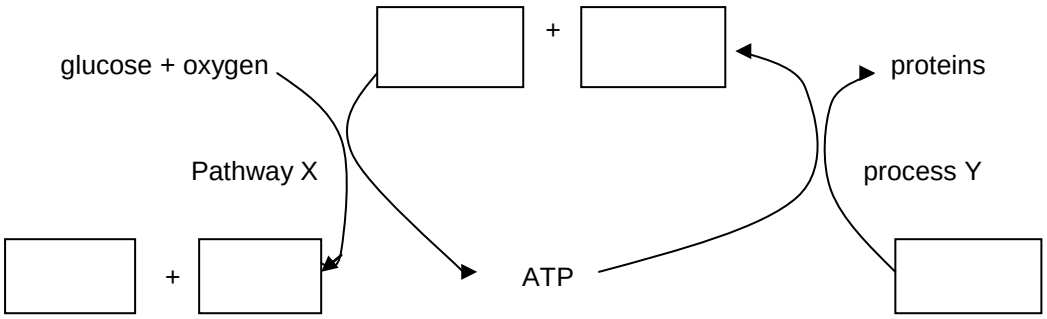
_____ 1

(e) Carbohydrate is stored in the body as a polysaccharide.
Name this polysaccharide and state where it is stored.

Name _____

Location _____ 1

37. The diagram shows the role of ATP in cell metabolism.



(a) Complete the diagram by entering the names of the appropriate substances. **3**

(b) (i) Name **one** stage of pathway **X** and state where it occurs in the cell.

Stage _____ Location _____ **1**

(ii) Name the organelle where process **Y** occurs.

_____ **1**

(c) Describe **two** ways in which the diagram would be different under anaerobic conditions.

1 _____

_____

2 _____

_____ **2**

(d) Name a respiratory substrate other than glucose.

_____ **1**

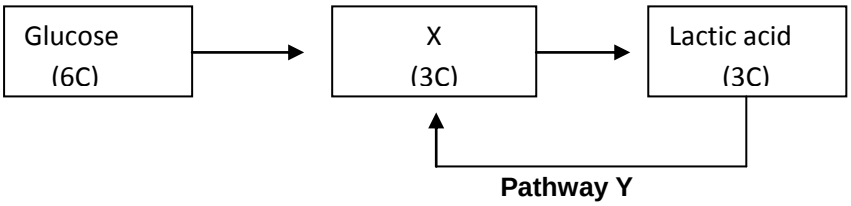
38. (a) The table below contains three statements about two stages of cellular respiration.

Complete the table to indicate whether the statements are True (T) or False (F) for each stage.

	Stages of Respiration	
Statement	Glycolysis	Cytochrome System
Occurs in the mitochondrion		**T**
Releases carbon dioxide	**F**	
Uses oxygen		

2

(b) The diagram below summarises anaerobic respiration in a muscle cell.



Pathway Y

(i) Name substance X

_____ **1**

(ii) Which substance would need o be present for pathway Y to occur?

_____ **1**

(iii) Why is anaerobic respiration considered to be a less efficient process than aerobic respiration?

_____ **1**

(iv) Glucose is not stored in muscle cells.
Name the carbohydrate which is stored in muscle cells.

_____ **1**

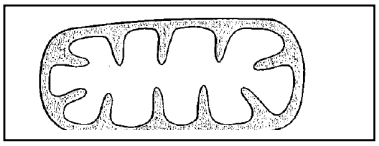
39. The table below shows the results of chemical tests on five carboydrates.

	Chemical test			
Carbohydrate	Iodine solution	Benedict's solution	Barfoeds's regent	Clinistix strip
Starch	Turns blue-black	Stays blue	Stays blue	Stays pink
Sucrose	Stays brown	Stays blue	Stays blue	Stays pink
Lactose	Stays brown	Turns orange	Stays blue	Stays pink
Fructose	Stays brown	Turns orange	Turns orange	Stays pink
Glucose	Stays brown	Turns orange	Turns orange	Turns purple

What is the minimum number of tests that would need to be carried out to identify an unknown carboydrates as lactose?

A. One
B. Two
C. Three
D. Four

40. What is the name of the cell structure shown in the diagram below?



A. Golgi body
B. Mitochondrion
C. Lysosome
D. Ribosome

41. Which of the following must be present for glycolysis to occur?

A. Glucose and oxygen
B. ATP and oxygen
C. Glucose
D. ATP and pyruvic acid