READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO NOT WRITE IN ANY BARCODES.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.
1. Which characteristics are found in all living organisms?

<table>
<thead>
<tr>
<th></th>
<th>excretion</th>
<th>growth</th>
<th>photosynthesis</th>
<th>respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>B</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>C</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>D</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

2. Uncooked pieces of potato of identical size were placed in different liquids for one hour.

1. pure water
2. sugar solution less concentrated than the cell contents
3. sugar solution more concentrated than the cell contents
4. sugar solution of the same concentration as the cell contents

After this time, which liquids will cause an increase in the size of the pieces of potato?

A  1, 2 and 4  B  1, 3 and 4  C  1 and 2 only  D  1 only

3. Which row identifies the graphs that show the effect of temperature and the effect of pH on an enzyme-controlled reaction?

<table>
<thead>
<tr>
<th></th>
<th>temperature</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>graph 1</td>
<td>graph 2</td>
</tr>
<tr>
<td>B</td>
<td>graph 2</td>
<td>graph 3</td>
</tr>
<tr>
<td>C</td>
<td>graph 1</td>
<td>graph 3</td>
</tr>
<tr>
<td>D</td>
<td>graph 3</td>
<td>graph 2</td>
</tr>
</tbody>
</table>

4. What helps maintain healthy gums?

A  calcium
B  iron
C  vitamin C
D  vitamin D
5 What is a function of the small intestine?
   A It cuts food into small pieces.
   B It provides a large surface area for absorption.
   C It provides space for the storage of faeces.
   D It stores food.

6 The graphs P, Q and R show the changes in the volume of air in the lungs of the same person, measured after different levels of activities.

Which row shows the correct graph for each level of activity?

<table>
<thead>
<tr>
<th></th>
<th>at rest</th>
<th>immediately after 10 minutes of running</th>
<th>immediately after 10 minutes of walking</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>Q</td>
<td>R</td>
</tr>
<tr>
<td>B</td>
<td>P</td>
<td>R</td>
<td>Q</td>
</tr>
<tr>
<td>C</td>
<td>R</td>
<td>Q</td>
<td>P</td>
</tr>
<tr>
<td>D</td>
<td>R</td>
<td>P</td>
<td>Q</td>
</tr>
</tbody>
</table>
7 Which word equation represents aerobic respiration?
   A carbon dioxide + glucose → oxygen + water
   B glucose + oxygen → carbon dioxide + water
   C oxygen + water → carbon dioxide + glucose
   D water + carbon dioxide → glucose + oxygen

8 How does adrenaline affect blood glucose concentration and pulse rate?

<table>
<thead>
<tr>
<th></th>
<th>blood glucose concentration</th>
<th>pulse rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>decreases</td>
<td>decreases</td>
</tr>
<tr>
<td>B</td>
<td>decreases</td>
<td>increases</td>
</tr>
<tr>
<td>C</td>
<td>increases</td>
<td>decreases</td>
</tr>
<tr>
<td>D</td>
<td>increases</td>
<td>increases</td>
</tr>
</tbody>
</table>

9 Diagram 1 shows a growing seedling after the first few days’ growth.
   The seedling was then rotated, held in the position shown in diagram 2 and placed in the dark for three days.

   What is the shape of the seedling three days later?

   A
   B
   C
   D
10 What are the features of sexual reproduction?

<table>
<thead>
<tr>
<th>fusion of nuclei</th>
<th>nature of offspring</th>
</tr>
</thead>
<tbody>
<tr>
<td>A no</td>
<td>genetically dissimilar</td>
</tr>
<tr>
<td>B yes</td>
<td>genetically identical</td>
</tr>
<tr>
<td>C no</td>
<td>genetically identical</td>
</tr>
<tr>
<td>D yes</td>
<td>genetically dissimilar</td>
</tr>
</tbody>
</table>

11 The diagram shows a section through an insect-pollinated flower.

Which labels are correct?

<table>
<thead>
<tr>
<th></th>
<th>anther</th>
<th>petal</th>
<th>sepal</th>
<th>stigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
12 The diagram shows a food web.

Which organisms are both primary and secondary consumers?
A small fish only
B protozoa and rotifers
C protozoa only
D rotifers only

13 Which gas builds up in the atmosphere as a result of deforestation?
A carbon dioxide
B methane
C nitrogen
D oxygen

14 The diagram shows apparatus used for filtration.

Why can sugar and salt not be separated by using this apparatus?
A They are both compounds.
B They are both white.
C They both dissolve in water.
D They both have the same size particles.
15 Copper sulfate crystals dissolve in water.

Which word describes the role of the water?

A filtrate
B solute
C solution
D solvent

16 Which row describes an ionic compound?

<table>
<thead>
<tr>
<th></th>
<th>melting point/°C</th>
<th>electrical conductivity when solid</th>
<th>electrical conductivity when dissolved in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>−7</td>
<td>poor</td>
<td>good</td>
</tr>
<tr>
<td>B</td>
<td>119</td>
<td>poor</td>
<td>insoluble</td>
</tr>
<tr>
<td>C</td>
<td>801</td>
<td>poor</td>
<td>good</td>
</tr>
<tr>
<td>D</td>
<td>3652</td>
<td>good</td>
<td>insoluble</td>
</tr>
</tbody>
</table>

17 Aluminium sulfate contains two aluminium atoms, three sulfur atoms and twelve oxygen atoms.

What is the formula of aluminium sulfate?

A $2\text{Al}_3\text{S}_6\text{O}$    B $2\text{Al}_3\text{S}_3\text{O}_{12}$    C $\text{Al}_2(\text{SO}_4)_3$    D $\text{Al}_2\text{S}_3(\text{SO}_4)$
18 Molten lead(II) bromide is electrolysed using inert electrodes.

What is formed at each electrode?

<table>
<thead>
<tr>
<th></th>
<th>anode</th>
<th>cathode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>grey solid</td>
<td>orange-brown gas</td>
</tr>
<tr>
<td>B</td>
<td>grey solid</td>
<td>grey solid</td>
</tr>
<tr>
<td>C</td>
<td>orange-brown gas</td>
<td>orange-brown gas</td>
</tr>
<tr>
<td>D</td>
<td>orange-brown gas</td>
<td>grey solid</td>
</tr>
</tbody>
</table>

19 When an excess of zinc is added to dilute hydrochloric acid, a gas is released.

Which pieces of apparatus are needed to investigate the rate of this reaction?

1 balance
2 gas syringe
3 stop watch
4 thermometer

A 1 and 2    B 1 and 4    C 2 and 3    D 3 and 4
20 Methane reacts with copper oxide.

The equation for the reaction is shown.

$$4\text{CuO} + \text{CH}_4 \rightarrow 4\text{Cu} + \text{CO}_2 + 2\text{H}_2\text{O}$$

Which statement about this reaction is correct?

A Carbon is reduced.
B Copper oxide is oxidised.
C It is a redox reaction.
D Methane is reduced.

21 Which aqueous ion gives a white precipitate with aqueous sodium hydroxide and with aqueous ammonia?

A $\text{Cu}^{2+}$
B $\text{Fe}^{2+}$
C $\text{Fe}^{3+}$
D $\text{Zn}^{2+}$

22 Which row describes the physical state of the Group VII elements at room temperature?

<table>
<thead>
<tr>
<th></th>
<th>chlorine</th>
<th>bromine</th>
<th>iodine</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>gas</td>
<td>gas</td>
<td>liquid</td>
</tr>
<tr>
<td>B</td>
<td>gas</td>
<td>liquid</td>
<td>solid</td>
</tr>
<tr>
<td>C</td>
<td>liquid</td>
<td>liquid</td>
<td>gas</td>
</tr>
<tr>
<td>D</td>
<td>liquid</td>
<td>solid</td>
<td>solid</td>
</tr>
</tbody>
</table>

23 Which gas is used to fill lamps?

A argon
B carbon dioxide
C hydrogen
D oxygen

24 Which two elements do not form an alloy?

A carbon and sulfur
B carbon and iron
C copper and zinc
D silver and gold
25 Two open containers, X and Y, are inside a glass tube.

Steam passes over solids in X and Y, as shown.

X contains anhydrous copper(II) sulfate.

Y contains hydrated cobalt(II) chloride.

What is observed?

A The solid in X remains blue.
B The solid in X turns from white to blue.
C The solid in Y turns from blue to pink.
D The solid in Y turns from pink to white.

26 Which statement shows that petroleum is a mixture?

A Petroleum can be burned as a fuel.
B Petroleum can be separated into fractions by distillation.
C Petroleum is a fossil fuel formed over millions of years.
D Petroleum is a thick, black liquid.

27 Which statement about alkanes is not correct?

A Alkanes are unsaturated hydrocarbons.
B Alkanes burn to release heat energy.
C Alkanes form carbon dioxide and water when they burn.
D Alkane molecules contain only single bonds.
28 Which labelled part of the electromagnetic spectrum is often involved in thermal energy transfer by radiation?

<table>
<thead>
<tr>
<th>radio waves</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>gamma rays</th>
</tr>
</thead>
<tbody>
<tr>
<td>visible light</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29 What does the gradient of a speed–time graph represent?

A  acceleration  
B  average speed  
C  distance travelled  
D  time taken  

30 The diagram shows a tug-of-war between team X and team Y.

The arrows show the forces exerted by the teams on the rope.

What is the size of the resultant force on the rope and in which direction does the resultant force act?

<table>
<thead>
<tr>
<th></th>
<th>size of resultant force / N</th>
<th>direction of resultant force</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75</td>
<td>to the left</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
<td>to the right</td>
</tr>
<tr>
<td>C</td>
<td>725</td>
<td>to the left</td>
</tr>
<tr>
<td>D</td>
<td>725</td>
<td>to the right</td>
</tr>
</tbody>
</table>
31 A ball made of soft clay is dropped and hits the ground. It does not bounce.

What energy changes take place as the ball drops and hits the ground?
A  gravitational potential → kinetic → thermal
B  gravitational potential → thermal → kinetic
C  kinetic → gravitational potential → thermal
D  kinetic → thermal → gravitational potential

32 Which two quantities are used to calculate the power produced by a car engine?
A  the speed of the car and the distance the car has travelled
B  the speed of the car and the time for the journey
C  the work done by the engine and the distance the car has travelled
D  the work done by the engine and the time taken to do the work

33 Benzene and glycerine are two substances.

The table gives the melting point and the boiling point of benzene and of glycerine.

<table>
<thead>
<tr>
<th></th>
<th>melting point / °C</th>
<th>boiling point / °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>5.4</td>
<td>80</td>
</tr>
<tr>
<td>glycerine</td>
<td>18</td>
<td>290</td>
</tr>
</tbody>
</table>

At which temperature are both benzene and glycerine liquid?
A  0 °C      B  50 °C      C  90 °C      D  300 °C
34  The diagram shows a vacuum flask containing a hot liquid in a cold room. X and Y are points on the inside surfaces of the walls of the flask.

How is thermal energy transferred through the vacuum between X and Y?

A  by conduction and convection
B  by conduction only
C  by radiation and convection
D  by radiation only

35  The diagram represents a wave at one moment.

Which labelled arrows represent the amplitude and the wavelength of the wave?

<table>
<thead>
<tr>
<th></th>
<th>amplitude</th>
<th>wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>B</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>Q</td>
<td>R</td>
</tr>
<tr>
<td>D</td>
<td>Q</td>
<td>S</td>
</tr>
</tbody>
</table>
36 Which row describes the characteristics of the image of an object formed by a plane mirror?

<table>
<thead>
<tr>
<th>type of image</th>
<th>size of image</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  real</td>
<td>same as object</td>
</tr>
<tr>
<td>B  real</td>
<td>smaller than object</td>
</tr>
<tr>
<td>C  virtual</td>
<td>same as object</td>
</tr>
<tr>
<td>D  virtual</td>
<td>smaller than object</td>
</tr>
</tbody>
</table>

37 The amplitude of a sound wave decreases and its frequency increases.

What happens to the sound heard?

A It becomes louder and its pitch becomes higher.
B It becomes louder and its pitch becomes lower.
C It becomes quieter and its pitch becomes higher.
D It becomes quieter and its pitch becomes lower.

38 The diagram shows a circuit set up by a student.

How is the resistance of the resistor calculated?

A \( \frac{\text{ammeter reading}}{\text{voltmeter reading}} \)
B \( \text{ammeter reading} \times \text{voltmeter reading} \)
C \( \frac{\text{voltmeter reading}}{\text{ammeter reading}} \)
D \( \text{voltmeter reading} + \text{ammeter reading} \)
39 A circuit contains four ammeters P, Q, R and S.

![Diagram of a circuit with ammeters P, Q, R, and S]

Which of these ammeters show the greatest reading?

A P only  
B P and Q  
C R only  
D R and S

40 A mains circuit can safely supply a current of up to 40 A.

The current in a hairdryer is 2 A when it is operating normally. The hairdryer is connected to the mains by a lead which can safely carry up to 5 A.

What is the correct fuse to protect the hairdryer?

A 1 A fuse  
B 3 A fuse  
C 10 A fuse  
D 50 A fuse
The volume of one mole of any gas is 24 dm$^3$ at room temperature and pressure (r.t.p.).