PHYSICAL SCIENCE
0652/02
Paper 2 Multiple Choice (Extended)
For Examination from 2019
SPECIMEN PAPER
45 minutes
Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

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 18.
Electronic calculators may be used.
1 The diagram shows the results of a chromatography experiment.

Which two substances are pure?

A U and X  
B U and Z  
C V and Y  
D V and W

2 The diagrams show two different atoms.

Which statement is not correct?

A Atoms P and Q are isotopes of the same element.  
B Atom P has the electronic configuration 2,3.  
C Atom Q is boron.  
D The nucleon number of atom P is 9.
3 The diagram shows the bonding electrons in a covalent molecule.

Which molecule is shown?

A chlorine
B hydrogen chloride
C methane
D water

4 The structures of two different forms of carbon are shown.

Which statement is correct?

A Diamond does not conduct electricity because its atoms are unable to move.

B Diamond has a high melting point because of strong ionic bonds between its atoms.

C Graphite conducts electricity because some electrons are free to move.

D Graphite has a low melting point because of weak bonds between the layers.
The diagram shows the structure of ethanoic acid.

What is the formula of ethanoic acid?

A  CHO  
B  C₂H₄O₂  
C  CH₃CO₂  
D  C₂H₃O₂

10 cm³ of propene, C₃H₆, are reacted with 60 cm³ of oxygen.

The equation for the reaction is

\[ 2C₃H₆(g) + 9O₂(g) \rightarrow 6CO₂(g) + 6H₂O(l) \]

What is the total volume of gas remaining at the end of the reaction?
All volumes are measured at room temperature and pressure.

A  30 cm³  
B  45 cm³  
C  60 cm³  
D  75 cm³

500 cm³ of a solution contains 2.8 g of potassium hydroxide, KOH.

What is the concentration of potassium hydroxide in this solution?

A  0.025 mol/dm³  
B  0.05 mol/dm³  
C  0.10 mol/dm³  
D  0.25 mol/dm³

What is the effect of reducing the temperature on the particles in a chemical reaction?

A  They collide less frequently and more particles reach the activation energy.  
B  They collide more frequently and more particles reach the activation energy.  
C  They collide less frequently and fewer particles reach the activation energy.  
D  They collide more frequently and fewer particles reach the activation energy.
9 Zinc reacts with steam to form zinc oxide and hydrogen.

\[ \text{Zn} + \text{H}_2\text{O} \rightarrow \text{ZnO} + \text{H}_2 \]

During the reaction, which substance is oxidised?

A hydrogen  
B water  
C zinc  
D zinc oxide

10 Ammonia is a base.

What is a base?

A an electron acceptor  
B an electron donor  
C a proton acceptor  
D a proton donor

11 Reactions of three different oxides X, Y and Z are described.

X reacts with both hydrochloric acid and sodium hydroxide.

Y does not react with either hydrochloric acid or sodium hydroxide.

Z does not react with hydrochloric acid but does react with sodium hydroxide.

Which row describes the three oxides?

<table>
<thead>
<tr>
<th></th>
<th>acidic</th>
<th>amphoteric</th>
<th>neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X</td>
<td>Z</td>
<td>Y</td>
</tr>
<tr>
<td>B</td>
<td>Y</td>
<td>X</td>
<td>Z</td>
</tr>
<tr>
<td>C</td>
<td>Z</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>D</td>
<td>Z</td>
<td>Y</td>
<td>X</td>
</tr>
</tbody>
</table>

12 Which gas turns damp red litmus paper blue?

A ammonia  
B chlorine  
C hydrogen  
D sulfur dioxide
13 An atom of a Group VI element contains 16 electrons.

How many electrons are in the outer shell of this atom?

A  2
B  6
C  8
D  16

14 Element Y is a transition element.

Which row in the table describes element Y?

<table>
<thead>
<tr>
<th></th>
<th>forms coloured compounds</th>
<th>high density</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>B</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>C</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>D</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>

15 The structure of pure iron is described as a lattice of positive ions in a 'sea of electrons'.

Which statements about pure iron are correct?

1  Iron conducts electricity because electrons are free to move.
2  Iron has a high melting point due to strong covalent bonds.
3  Iron is an alloy.
4  Iron is malleable because the layers of atoms can slide over each other.

A  1 only
B  1 and 3
C  1 and 4
D  2, 3 and 4
16 Which of the following reactions occur in the blast furnace?

1 \( \text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O} \)

2 \( \text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3 \)

3 \( \text{CO}_2 + \text{C} \rightarrow 2\text{CO} \)

4 \( \text{Fe}_2\text{O}_3 + 3\text{H}_2 \rightarrow 2\text{Fe} + 3\text{H}_2\text{O} \)

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

17 Nitrogen oxides and carbon monoxide are produced in a car engine when petrol is burned.

The exhaust gases from the engine pass through a catalytic converter. The following reaction takes place.

\[ 2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2 \]

Which statement is not correct?

A Carbon monoxide is oxidised by the nitrogen oxides.
B Carbon monoxide is produced by the complete combustion of petrol.
C Nitrogen oxides are formed when nitrogen burns in oxygen.
D Nitrogen oxides are reduced in the catalytic converter.

18 Which row in the table shows the correct uses of the fractions obtained from petroleum?

<table>
<thead>
<tr>
<th>petrol</th>
<th>refinery gases</th>
<th>naphtha</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>fuel for cars</td>
<td>fuel for cooking</td>
</tr>
<tr>
<td>B</td>
<td>fuel for cars</td>
<td>fuel for diesel engines</td>
</tr>
<tr>
<td>C</td>
<td>fuel for diesel engines</td>
<td>fuel for cooking</td>
</tr>
<tr>
<td>D</td>
<td>fuel for diesel engines</td>
<td>fuel for cars</td>
</tr>
</tbody>
</table>
19 The word equation shows a reaction of ethene.

\[
\text{ethene} + \text{substance X} \xrightarrow{\text{catalyst}} \text{ethane}
\]

Which type of reaction occurs and what is X?

<table>
<thead>
<tr>
<th>type of reaction</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>A addition</td>
<td>hydrogen</td>
</tr>
<tr>
<td>B addition</td>
<td>steam</td>
</tr>
<tr>
<td>C oxidation</td>
<td>hydrogen</td>
</tr>
<tr>
<td>D oxidation</td>
<td>steam</td>
</tr>
</tbody>
</table>

20 Ethanol is produced by the fermentation of glucose.

Which statement about fermentation is **not** correct?

A Carbon dioxide is produced in the reaction.
B Ethanol is produced in the absence of oxygen.
C The reaction only takes place between 50 °C and 60 °C.
D Yeast provides the catalyst for the reaction.

21 A pendulum swings between point X and point Y.

A student wishes to measure the period of the pendulum.

Which method produces the most accurate value for the period?

A measure the time for the pendulum to move from X to Y once
B measure the time for the pendulum to move from X to Y ten times and divide this time by ten
C measure the time for the pendulum to move from X to Y and back to X once
D measure the time for the pendulum to move from X to Y and back to X ten times and divide this time by ten
22 What quantity does the area under a speed-time graph represent?

A acceleration
B average velocity
C distance travelled
D initial velocity

23 An astronaut in an orbiting spacecraft experiences a force due to gravity. This force is less than when she is on the Earth’s surface.

Compared with being on the Earth’s surface, how do her mass and her weight change, if at all, when she is in orbit?

<table>
<thead>
<tr>
<th></th>
<th>mass in orbit</th>
<th>weight in orbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>decreased</td>
<td>decreased</td>
</tr>
<tr>
<td>B</td>
<td>decreased</td>
<td>unchanged</td>
</tr>
<tr>
<td>C</td>
<td>unchanged</td>
<td>decreased</td>
</tr>
<tr>
<td>D</td>
<td>unchanged</td>
<td>unchanged</td>
</tr>
</tbody>
</table>

24 An experiment is carried out to measure the extension of a rubber band for different loads.

The results are shown below.

<table>
<thead>
<tr>
<th>load / N</th>
<th>0</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>length/cm</td>
<td>15.2</td>
<td>16.2</td>
<td>18.6</td>
<td></td>
</tr>
<tr>
<td>extension/cm</td>
<td>0</td>
<td>1.0</td>
<td>2.1</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Which figure is missing from the table?

A 17.2
B 17.3
C 17.4
D 18.3
25 A pole-vaulter runs up to a jump with his pole straight. He puts one end of the pole down on the ground and the pole bends as he jumps.

Which form of energy is stored in the pole because it is bent?

A chemical
B elastic (strain)
C gravitational potential
D motion

26 Two different temperatures are measured. One temperature is constant, and very high (approximately 600 °C). The second temperature varies rapidly, and is approximately 60 °C.

Which row in the table shows a thermometer suitable for measuring each temperature?

<table>
<thead>
<tr>
<th></th>
<th>constant and very high temperature (approximately 600 °C)</th>
<th>rapidly varying temperature (approximately 60 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>liquid-in-glass</td>
<td>liquid-in-glass</td>
</tr>
<tr>
<td>B</td>
<td>liquid-in-glass</td>
<td>thermocouple</td>
</tr>
<tr>
<td>C</td>
<td>thermocouple</td>
<td>liquid-in-glass</td>
</tr>
<tr>
<td>D</td>
<td>thermocouple</td>
<td>thermocouple</td>
</tr>
</tbody>
</table>
A girl sits by a camp fire. She holds an iron rod with one end in the fire.

Heat from the fire reaches her hand.

How does heat from the fire reach her hand?

A conduction, convection and radiation
B conduction and convection
C conduction and radiation
D convection and radiation
28 Which diagram shows what happens to water waves when they pass from deep to shallow water?

A

B

C

D

29 The diagram shows a ray of light passing from air into a glass block. The values of two angles are shown.

![Diagram of a ray of light passing from air into a glass block]

What is the refractive index $n$ of the glass?

A 0.58
B 0.62
C 1.61
D 1.73
30  The diagram shows the paths of two rays of light from the top of an object. The rays pass through a converging lens. The principal focuses of the lens are labelled.

At which point, P or Q, is an image formed, and is the image real or virtual?

<table>
<thead>
<tr>
<th></th>
<th>position of image</th>
<th>real or virtual image?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>real</td>
</tr>
<tr>
<td>B</td>
<td>P</td>
<td>virtual</td>
</tr>
<tr>
<td>C</td>
<td>Q</td>
<td>real</td>
</tr>
<tr>
<td>D</td>
<td>Q</td>
<td>virtual</td>
</tr>
</tbody>
</table>

31  The diagram shows apparatus that is used to make a permanent magnet.

Which metal and which power supply are normally used to make a permanent magnet?

<table>
<thead>
<tr>
<th></th>
<th>metal</th>
<th>power supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>iron</td>
<td>a.c.</td>
</tr>
<tr>
<td>B</td>
<td>iron</td>
<td>d.c.</td>
</tr>
<tr>
<td>C</td>
<td>steel</td>
<td>a.c.</td>
</tr>
<tr>
<td>D</td>
<td>steel</td>
<td>d.c.</td>
</tr>
</tbody>
</table>
32 An electrical quantity is defined as the energy supplied by a source in driving a unit charge around a complete circuit.

What is this electrical quantity?

A current 
B e.m.f. 
C p.d. 
D power

33 A metal wire of length $l$ and cross-sectional area $A$ has resistance $R$.

What is the resistance of a wire of the same material, which has length $2l$ and cross-sectional area $2A$?

A $0.5R$ 
B $R$ 
C $2R$ 
D $4R$

34 Two resistors of $3.0\,\Omega$ and $6.0\,\Omega$ are connected in parallel.

What is their effective resistance?

A $2.0\,\Omega$ 
B $3.0\,\Omega$ 
C $6.0\,\Omega$ 
D $9.0\,\Omega$

35 Domestic appliances use electricity in a variety of ways.

Which electrical appliance includes both an electric motor and a heater?

A hairdryer 
B iron 
C kettle 
D vacuum cleaner
36 In the circuit shown, the current in the resistor is 4.0 A and the voltmeter reads 6.0 V. How much energy is transferred by the resistor in 2.0 minutes?

A 0.20 J  
B 12 J  
C 48 J  
D 2880 J

37 Which device uses slip rings?

A a d.c. motor  
B a thermacouple  
C a transformer  
D an a.c. generator

38 A transformer has an input voltage of 240 V and an output voltage of 12 V. The transformer is 100% efficient. An ammeter connected to the secondary coil shows a reading of 5.0 A. What is the current in the primary coil?

A 0.25 A  
B 5.0 A  
C 60 A  
D 100 A
39 A beam of $\gamma$-rays passes between two charged metal plates as shown in the diagram.

\[\begin{array}{cccccccc}
\gamma\text{-rays} & & & & & & &
\end{array}\]

\[\begin{array}{cccccccc}
+ & + & + & + & + & + & +
\end{array}\]

How do the $\gamma$-rays pass between the two charged plates?

A  The rays are deflected in a direction perpendicular to the page.
B  The rays are deflected towards the negative plate.
C  The rays are deflected towards the positive plate.
D  The rays continue in the same direction.

40 A powder contains 400 mg of a radioactive isotope.

The half-life of the isotope is 5 days.

What mass of this isotope remains after 10 days?

A  0 mg
B  40 mg
C  100 mg
D  200 mg
### The Periodic Table of Elements

<table>
<thead>
<tr>
<th>Group</th>
<th>Period</th>
<th>Periodic Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>1. H (hydrogen)</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>2. He (helium)</td>
</tr>
<tr>
<td>III</td>
<td>3</td>
<td>3. Li (lithium)</td>
</tr>
<tr>
<td>IV</td>
<td>4</td>
<td>4. Be (beryllium)</td>
</tr>
<tr>
<td>V</td>
<td>5</td>
<td>5. B (boron)</td>
</tr>
<tr>
<td>VI</td>
<td>6</td>
<td>6. C (carbon)</td>
</tr>
<tr>
<td>VII</td>
<td>7</td>
<td>7. N (nitrogen)</td>
</tr>
<tr>
<td>VIII</td>
<td>8</td>
<td>8. O (oxygen)</td>
</tr>
<tr>
<td>IX</td>
<td>9</td>
<td>9. F (fluorine)</td>
</tr>
<tr>
<td>X</td>
<td>10</td>
<td>10. Ne (neon)</td>
</tr>
</tbody>
</table>

#### Key
- **atomic number**
- **atomic symbol**
- **relative atomic mass**

#### Group I
- **1. H** (hydrogen)
- **2. He** (helium)

#### Group II
- **3. Li** (lithium)
- **4. Be** (beryllium)

#### Group III
- **5. B** (boron)
- **6. C** (carbon)
- **7. N** (nitrogen)
- **8. O** (oxygen)
- **9. F** (fluorine)
- **10. Ne** (neon)

#### Group IV
- **11. Na** (sodium)
- **12. Mg** (magnesium)

#### Group V
- **13. Al** (aluminium)
- **14. Si** (silicon)
- **15. P** (phosphorus)
- **16. S** (sulfur)
- **17. Cl** (chlorine)
- **18. Ar** (argon)

#### Group VI
- **19. K** (potassium)
- **20. Ca** (calcium)

#### Group VII
- **21. Na** (sodium)
- **22. Mg** (magnesium)

#### Group VIII
- **23. K** (potassium)
- **24. Ca** (calcium)

#### Actinoids
- **25. Rb** (rubidium)
- **26. Sr** (strontium)
- **27. Y** (yttrium)
- **28. Zr** (zirconium)
- **29. Nb** (niobium)
- **30. Mo** (molybdenum)
- **31. Tc** (technetium)
- **32. Re** (rhenium)
- **33. Os** (osmium)
- **34. Ir** (iridium)
- **35. Pt** (platinum)
- **36. Au** (gold)
- **37. Hg** (mercury)
- **38. Tl** (thallium)
- **39. Pb** (lead)
- **40. Bi** (bismuth)
- **41. Po** (polonium)
- **42. At** (astatine)
- **43. Rn** (radon)

#### Lanthanoids
- **44. Ce** (cerium)
- **45. Pr** (praseodymium)
- **46. Nd** (neodymium)
- **47. Sm** (samarium)
- **48. Eu** (europium)
- **49. Gd** (gadolinium)
- **50. Tb** (terbium)
- **51. Dy** ( dysprosium)
- **52. Ho** (holmium)
- **53. Er** (erbium)
- **54. Tm** (thulium)
- **55. Yb** (ytterbium)
- **56. Lu** (lanthanum)

#### The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).