

Name: \_\_\_\_\_ (      )                      Class: \_\_\_\_\_

YEAR THREE INTEGRATED PROGRAMME  
END-OF-YEAR ASSESSMENT

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**Chemistry**  
**Paper 1**

**30 September 2022**

**45 mins**

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**READ THESE INSTRUCTIONS FIRST**

Write your name, register number and class on the Answer Sheet using a soft pencil.

There are **30** questions in 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.

Amendments may be done using a soft eraser.

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 2.

The use of an approved scientific calculator is expected, where appropriate.

|                           |  |
|---------------------------|--|
| <b>For Examiner's Use</b> |  |
| <b>Total (30)</b>         |  |

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This document consists of **13** printed pages and **1** blank page



圣尼各拉女校  
**CHIJ ST NICHOLAS GIRLS' SCHOOL**

Girls of Grace • Women of Strength • Leaders with Heart

[Turn over

# The Periodic Table of Elements

|                         |                           | Group                    |                             |                             |                           |                             |                         |                              |                         |                            |                           |                            |                            |                           |                            |                             |                        |                          |                          |                          |                        |                           |                             |                           |                            |                           |                           |                            |                             |                          |                             |                           |                              |                             |                              |                            |                              |                           |                            |                           |                        |                             |                              |                          |                          |                            |                           |                      |                            |                             |                            |                            |                           |                            |                             |                         |                            |                             |                         |                            |                           |                           |                        |                           |                         |                     |                                 |                           |                              |                           |                           |                              |                                |                               |                               |                            |                             |                               |                              |                              |                            |
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| I                       | II                        | III                      | IV                          | V                           | VI                        | VII                         | 0                       |                              |                         |                            |                           |                            |                            |                           |                            |                             |                        |                          |                          |                          |                        |                           |                             |                           |                            |                           |                           |                            |                             |                          |                             |                           |                              |                             |                              |                            |                              |                           |                            |                           |                        |                             |                              |                          |                          |                            |                           |                      |                            |                             |                            |                            |                           |                            |                             |                         |                            |                             |                         |                            |                           |                           |                        |                           |                         |                     |                                 |                           |                              |                           |                           |                              |                                |                               |                               |                            |                             |                               |                              |                              |                            |
| 3<br>Li<br>lithium<br>7 | 4<br>Be<br>beryllium<br>9 | 11<br>Na<br>sodium<br>23 | 12<br>Mg<br>magnesium<br>24 | 13<br>Al<br>aluminium<br>27 | 14<br>Si<br>silicon<br>28 | 15<br>P<br>phosphorus<br>31 | 16<br>S<br>sulfur<br>32 | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40 | 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40 | 21<br>Sc<br>scandium<br>45 | 22<br>Ti<br>titanium<br>48 | 23<br>V<br>vanadium<br>51 | 24<br>Cr<br>chromium<br>52 | 25<br>Mn<br>manganese<br>55 | 26<br>Fe<br>iron<br>56 | 27<br>Co<br>cobalt<br>59 | 28<br>Ni<br>nickel<br>59 | 29<br>Cu<br>copper<br>64 | 30<br>Zn<br>zinc<br>65 | 31<br>Ga<br>gallium<br>70 | 32<br>Ge<br>germanium<br>73 | 33<br>As<br>arsenic<br>75 | 34<br>Se<br>selenium<br>79 | 35<br>Br<br>bromine<br>80 | 36<br>Kr<br>krypton<br>84 | 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89 | 40<br>Zr<br>zirconium<br>91 | 41<br>Nb<br>niobium<br>93 | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>- | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103 | 46<br>Pd<br>palladium<br>106 | 47<br>Ag<br>silver<br>108 | 48<br>Cd<br>cadmium<br>112 | 49<br>In<br>indium<br>115 | 50<br>Sn<br>tin<br>119 | 51<br>Sb<br>antimony<br>122 | 52<br>Te<br>tellurium<br>128 | 53<br>I<br>iodine<br>127 | 54<br>Xe<br>xenon<br>131 | 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137 | 57-71<br>lanthanoids | 72<br>Hf<br>hafnium<br>178 | 73<br>Ta<br>tantalum<br>181 | 74<br>W<br>tungsten<br>184 | 75<br>Re<br>rhenium<br>186 | 76<br>Os<br>osmium<br>190 | 77<br>Ir<br>iridium<br>192 | 78<br>Pt<br>platinum<br>195 | 79<br>Au<br>gold<br>197 | 80<br>Hg<br>mercury<br>201 | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207 | 83<br>Bi<br>bismuth<br>209 | 84<br>Po<br>polonium<br>- | 85<br>At<br>astatine<br>- | 86<br>Rn<br>radon<br>- | 87<br>Fr<br>francium<br>- | 88<br>Ra<br>radium<br>- | 89-103<br>actinoids | 104<br>Rf<br>Rutherfordium<br>- | 105<br>Db<br>dubnium<br>- | 106<br>Sg<br>seaborgium<br>- | 107<br>Bh<br>bohrium<br>- | 108<br>Hs<br>hassium<br>- | 109<br>Mt<br>meitnerium<br>- | 110<br>Ds<br>darmstadtium<br>- | 111<br>Rg<br>roentgenium<br>- | 112<br>Cn<br>copernicium<br>- | 113<br>Nh<br>nihonium<br>- | 114<br>Fl<br>flerovium<br>- | 115<br>Lv<br>livermorium<br>- | 116<br>Uu<br>unbinilium<br>- | 117<br>Ts<br>tennessine<br>- | 118<br>Og<br>oganeson<br>- |

**Key**

proton (atomic) number  
atomic symbol  
name  
relative atomic mass

1  
H  
hydrogen  
1

|                              |                            |                                 |                              |                             |                             |                             |                               |                            |                               |                              |                           |                               |                              |                              |
|------------------------------|----------------------------|---------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|-------------------------------|------------------------------|---------------------------|-------------------------------|------------------------------|------------------------------|
| 57<br>La<br>lanthanum<br>139 | 58<br>Ce<br>cerium<br>140  | 59<br>Pr<br>praseodymium<br>141 | 60<br>Nd<br>neodymium<br>144 | 61<br>Pm<br>promethium<br>- | 62<br>Sm<br>samarium<br>150 | 63<br>Eu<br>europium<br>152 | 64<br>Gd<br>gadolinium<br>157 | 65<br>Tb<br>terbium<br>159 | 66<br>Dy<br>dysprosium<br>163 | 67<br>Ho<br>holmium<br>165   | 68<br>Er<br>erbium<br>167 | 69<br>Tm<br>thulium<br>169    | 70<br>Yb<br>ytterbium<br>173 | 71<br>Lu<br>lutetium<br>175  |
| 89<br>Ac<br>actinium<br>-    | 90<br>Th<br>thorium<br>232 | 91<br>Pa<br>protactinium<br>231 | 92<br>U<br>uranium<br>238    | 93<br>Np<br>neptunium<br>-  | 94<br>Pu<br>plutonium<br>-  | 95<br>Am<br>americium<br>-  | 96<br>Cm<br>curium<br>-       | 97<br>Bk<br>berkelium<br>- | 98<br>Cf<br>californium<br>-  | 99<br>Es<br>einsteinium<br>- | 100<br>Fm<br>fermium<br>- | 101<br>Md<br>mendelevium<br>- | 102<br>No<br>nobelium<br>-   | 103<br>Lr<br>lawrencium<br>- |

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

**Topics Tested: Atomic Structure, Compounds, Elements and Mixtures, Bonding and Structure, Kinetic Particle Theory, Redox, Periodic Table, Mole Concept, Acids and Bases, Preparation of Salts, Qualitative Analysis.**

- 1 Which statement is true?
- A Ne has more electrons than  $F^-$ .
  - B  $F^-$  has more electrons than  $Na^+$ .
  - C  $Cu^{2+}$  has more electrons than  $Cu^+$ .
  - D  $O^{2-}$  has more electrons than O.
- 2 The rate of diffusion of gas P (Mr = 32) and gas Q (Mr = 64) was compared at 30 °C and 60 °C. Which would have the slowest rate of diffusion?
- A gas P at 30 °C
  - B gas P at 60 °C
  - C gas Q at 30 °C
  - D gas Q at 60 °C
- 3 In which species are the numbers of electrons and neutrons equal?
- A  ${}^9_4\text{Be}$
  - B  ${}^{19}_9\text{F}$
  - C  ${}^{23}_{11}\text{Na}^+$
  - D  ${}^{18}_8\text{O}^{2-}$

4 The isotope cobalt-60 ( ${}^{60}_{27}\text{Co}$ ) is used to destroy cancer cells in the human body. Which statements about an atom of cobalt-60 is/are correct?

- 1 It contains 33 neutrons.
- 2 Its nucleus has a relative charge of 27+.
- 3 It has different number of neutrons from the other isotopes of cobalt.

- A** 1 only  
**B** 1 and 2 only  
**C** 2 and 3 only  
**D** 1, 2 and 3

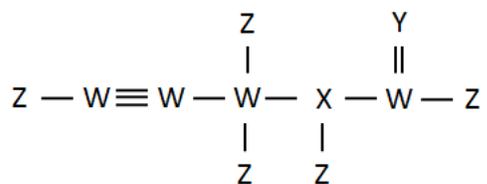
5 Which of the following pairs consists of two pure substances?

- A** diamond and aqueous iodine  
**B** hydrogen and bronze  
**C** hydrogen chloride and water  
**D** lithium and air

6 Which of the following best describes the arrangement of particles present in dilute aqueous ammonia?

|          | $\text{NH}_3$ molecules | $\text{OH}^-$ ions |
|----------|-------------------------|--------------------|
| <b>A</b> | Not present             | Close together     |
| <b>B</b> | Not present             | Far apart          |
| <b>C</b> | Close together          | Close together     |
| <b>D</b> | Far apart               | Far apart          |

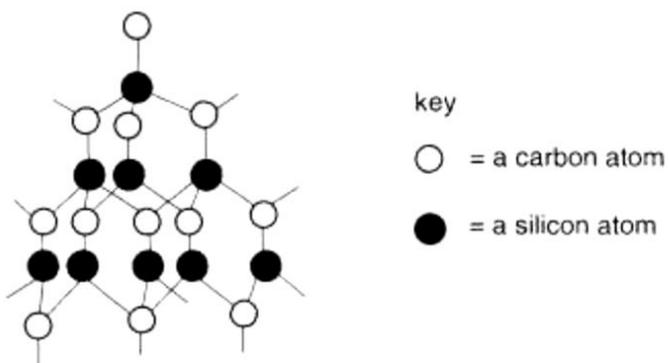
7 Study the molecule below:



In which group of the Periodic Table are elements W, X, Y and Z likely to be found?

|          | W         | X         | Y        | Z         |
|----------|-----------|-----------|----------|-----------|
| <b>A</b> | Group III | Group V   | Group VI | Group I   |
| <b>B</b> | Group IV  | Group III | Group VI | Group VII |
| <b>C</b> | Group III | Group V   | Group II | Group I   |
| <b>D</b> | Group IV  | Group V   | Group VI | Group VII |

8 The compound silicon carbide has the structure as shown:



Which property is not correct for this compound?

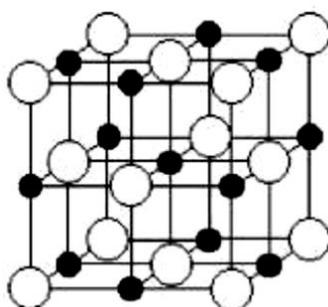
- A** It is hard.
- B** It is soluble in water.
- C** It has high melting point.
- D** It has poor electrical conductivity.

- 9 Coloured glass, such as those used in church windows, requires three oxides – one macromolecular, one ionic and one of a transition metal.

Which combination is likely to produce a coloured glass?

- A  $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{SnO}$
- B  $\text{P}_4\text{O}_{10}$ ,  $\text{CaO}$ ,  $\text{CuO}$
- C  $\text{SiO}_2$ ,  $\text{CaO}$ ,  $\text{PbO}$
- D  $\text{SiO}_2$ ,  $\text{PbO}$ ,  $\text{CoO}$

- 10 The diagram below shows the structure of sodium chloride.



key

-  = chloride ion
-  = sodium ion

Which of the following statements is false?

- A The structure is not able to conduct electricity in any physical states.
  - B Each sodium ion is surrounded by 6 chloride ions.
  - C The ratio of the ions is 1:1.
  - D The structure is held together by strong electrostatic forces of attraction.
- 11 In which of the following does sulfur exhibit the highest oxidation state?

- A  $\text{S}_8$
- B  $\text{SO}_2$
- C  $\text{Na}_2\text{S}_2\text{O}_3$
- D  $\text{H}_2\text{SO}_4$

- 12 Which of the following reactions does hydrogen gas behave as an oxidising agent?
- A  $2\text{Na} + \text{H}_2 \rightarrow \text{NaH}$
  - B  $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$
  - C  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
  - D  $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
- 13 How many moles of carbon are present in 18 g of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ ?
- A 0.1 mole
  - B 0.6 mole
  - C 1.0 mole
  - D 6.0 mole
- 14 'Iron tablets' can be consumed as a supplement to one's diet. They contain iron(II) sulfate. The percentage of iron in the tablets can be determined through a titration, where iron(II) is converted to iron(III). Which of the following aqueous reagents could be best used under suitable conditions to carry out the titration?
- A nitric acid
  - B potassium iodide
  - C potassium manganate(VII)
  - D sodium sulfite
- 15 Silver nitrate and barium chloride react according to the equation below.
- $$2\text{AgNO}_3 (\text{aq}) + \text{BaCl}_2 (\text{aq}) \rightarrow 2\text{AgCl} (\text{s}) + \text{Ba}(\text{NO}_3)_2 (\text{aq})$$
- What is the volume of  $0.10 \text{ mol/dm}^3$  aqueous silver nitrate that reacts completely with  $20 \text{ cm}^3$  of  $0.20 \text{ mol/dm}^3$  of barium chloride?
- A  $10 \text{ cm}^3$
  - B  $20 \text{ cm}^3$
  - C  $40 \text{ cm}^3$
  - D  $80 \text{ cm}^3$

- 16 An acyl chloride,  $C_6H_5COCl$  reacts with an alcohol,  $C_6H_5OH$  according to the equation below.



What is the percentage yield if 0.8 g of  $C_6H_5COOC_6H_5$  was obtained from 1.2 g of the acyl chloride?

[Mr of  $C_6H_5COCl$  is 140.5; Mr of  $C_6H_5COOC_6H_5$  is 198]

- A 47.3%
- B 66.7%
- C 71.0%
- D 94.0%
- 17 Aqueous lead(II) nitrate cannot be used to differentiate
- A dilute sulfuric acid from dilute hydrochloric acid.
- B aqueous potassium iodide from aqueous potassium chloride.
- C aqueous sodium hydroxide from aqueous ammonia.
- D aqueous sodium carbonate from aqueous sodium nitrate.
- 18 Which of the following is suitable for the preparation of potassium chloride?
- A potassium with dilute hydrochloric acid
- B potassium hydroxide with dilute hydrochloric acid
- C potassium chloride with dilute sulfuric acid
- D potassium carbonate with sodium chloride solution
- 19 A blue solution contains two sulfate salts. When aqueous ammonia is added to the solution, a blue precipitate is formed, which dissolves in excess aqueous ammonia to form a deep blue solution. Which are the two cations in the solution?
- A  $Cu^{2+}$  and  $Zn^{2+}$
- B  $Cu^{2+}$  and  $Ca^{2+}$
- C  $Cu^{2+}$  and  $Pb^{2+}$
- D  $Cu^{2+}$  and  $Al^{3+}$

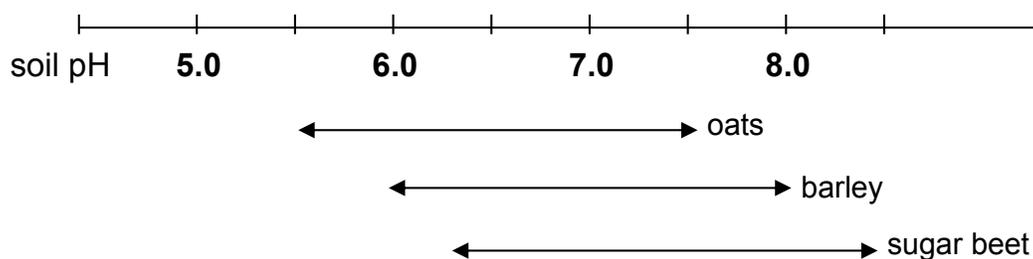
- 20** The reaction between  $\text{CuCO}_3$  and  $\text{HNO}_3$  is as shown in the equation.



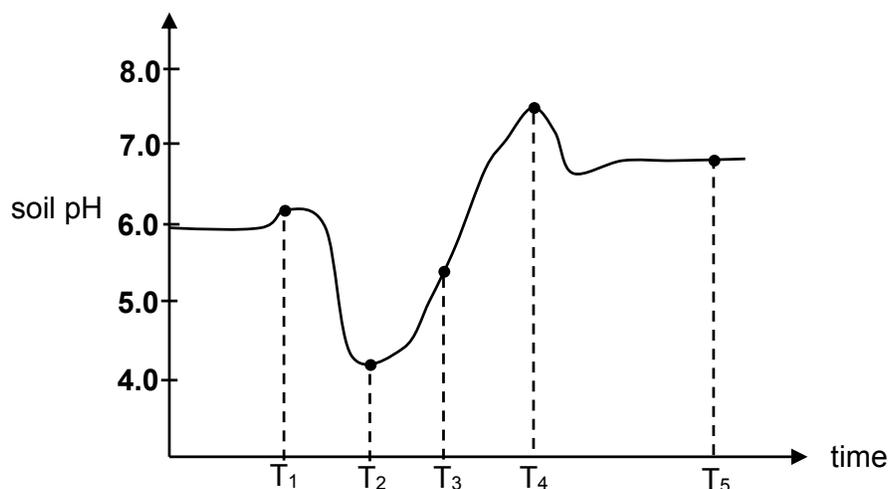
What would be observed if 18.6 g of  $\text{CuCO}_3$  is reacted with 0.4 dm<sup>3</sup> of 0.5 mol/dm<sup>3</sup>  $\text{HNO}_3$ ?

- A** Blue solution only.
- B** Colourless solution only.
- C** Blue solution with green solid.
- D** Colourless solution with green solid.
- 21** Which of the following statements is correct about the elements going from left to right in Period 2 of the Periodic Table?
- A** The metallic properties of the elements increases.
- B** The oxidising ability of the elements increases.
- C** The tendency of the elements to gain electron decreases.
- D** The number of valence electrons decreases.
- 22** An element Y reacts with oxygen to form two gases with the formulae YO and YO<sub>2</sub>. YO is neutral to litmus while YO<sub>2</sub> reacts with alkalis to form salt and water only. What does this suggest about Element Y?
- A** It is an alkali metal.
- B** It is a non-metal in Group IV.
- C** It is a metal in Group II.
- D** It is a halogen.

- 23 The table shows the pH ranges required by different crops for growth.



The graph shows how the pH value of the soil in a farmer's field changes over time.

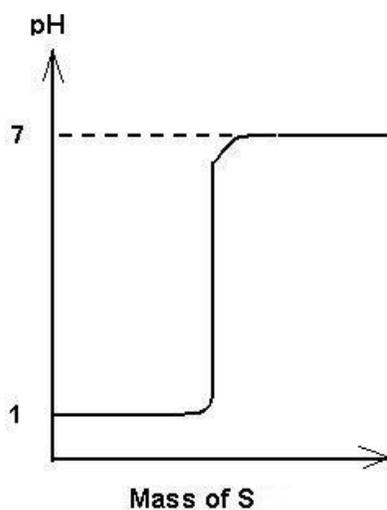


The farmer wants to grow oats, barley and sugar beet. In which period of time would **all** three crops grow well?

- A** between T<sub>1</sub> and T<sub>2</sub>
- B** between T<sub>2</sub> and T<sub>3</sub>
- C** between T<sub>3</sub> and T<sub>4</sub>
- D** between T<sub>4</sub> and T<sub>5</sub>
- 24 Both chlorine and iodine belong to Group VII of the Periodic Table. Which statement about these elements is correct?
- A** Both are diatomic gases at room temperature and pressure.
- B** Iodine is a stronger oxidising agent than chlorine.
- C** Iodine has a higher melting point than chlorine.
- D** Iodine will react with a solution of sodium chloride.

- 25** Which of the following properties of argon is applied when used for filling light bulbs?
- A** It is inert.
  - B** It is colourless.
  - C** It is monatomic.
  - D** It is less dense than air.
- 26** Which of the following statements regarding the reaction between excess sulfuric acid and barium hydroxide is/are true?
1. The ion of the highest concentration in the resulting mixture is  $\text{SO}_4^{2-}$ .
  2. The ionic equation of the reaction is  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ .
  3. The pH of the resulting mixture is 7.
- A** 1 only
  - B** 1 and 2 only
  - C** 2 and 3 only
  - D** none of the above
- 27** Which characteristic of Group I metals is correct as their number of electron shells increases?
- A** Their atomic size decreases.
  - B** They form ions with higher charge.
  - C** Their melting and boiling point increases.
  - D** The tendency to lose electrons increases.

- 28 A solid S was gradually added till excess to a fixed volume of dilute hydrochloric acid. The pH changes in solution were recorded by a datalogger as shown.



What could solid S be?

- A copper
  - B copper(II) oxide
  - C sodium
  - D sodium hydroxide
- 29 Which of the following bases produces the highest concentration of hydroxide ions when 1 mole of the compound is added to the same volume of water?
- A ammonia
  - B barium hydroxide
  - C sodium hydroxide
  - D iron(II) hydroxide

**30** The results of some tests on a solution of compound X are shown in the table.

| test   | result  |
|--|---|
| aqueous ammonia                                | white precipitate formed, insoluble in excess                           |
| aqueous sodium hydroxide, aluminium foil, warm | colourless pungent gas produced which turns moist red litmus paper blue |
| aqueous potassium iodide                       | yellow precipitate formed   |

What could compound X be?

- A** aluminium iodide
- B** aluminium nitrate
- C** lead(II) iodide
- D** lead(II) nitrate

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**2022 S3 EOY MCQ Answers**

|            |          |            |          |           |          |            |          |
|------------|----------|------------|----------|-----------|----------|------------|----------|
| <b>1</b>   | <b>D</b> | <b>2</b>   | <b>C</b> | <b>3</b>  | <b>D</b> | <b>4</b>   | <b>D</b> |
| <b>5</b>   | <b>C</b> | <b>6</b>   | <b>D</b> | <b>7</b>  | <b>D</b> | <b>8</b>   | <b>B</b> |
| <b>9</b>   | <b>D</b> | <b>10*</b> | <b>A</b> | <b>11</b> | <b>D</b> | <b>12*</b> | <b>A</b> |
| <b>13</b>  | <b>B</b> | <b>14*</b> | <b>C</b> | <b>15</b> | <b>D</b> | <b>16</b>  | <b>A</b> |
| <b>17*</b> | <b>A</b> | <b>18</b>  | <b>B</b> | <b>19</b> | <b>A</b> | <b>20</b>  | <b>C</b> |
| <b>21</b>  | <b>B</b> | <b>22</b>  | <b>B</b> | <b>23</b> | <b>D</b> | <b>24</b>  | <b>C</b> |
| <b>25</b>  | <b>A</b> | <b>26</b>  | <b>D</b> | <b>27</b> | <b>D</b> | <b>28</b>  | <b>B</b> |
| <b>29</b>  | <b>B</b> | <b>30</b>  | <b>D</b> |           |          |            |          |