



# DAMAI SECONDARY SCHOOL

## Preliminary Examination 2022

CANDIDATE NAME

CLASS

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INDEX NUMBER

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### CHEMISTRY

6092/01

Paper 1 Multiple Choice

23 August 2022

Secondary 4 Express

1 hour

Setter: Ms See Pei Zhen

40 marks

Additional Materials: Multiple Choice Answer Sheet

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### READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on all the work you hand in.

There are **forty** questions in this section. 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.

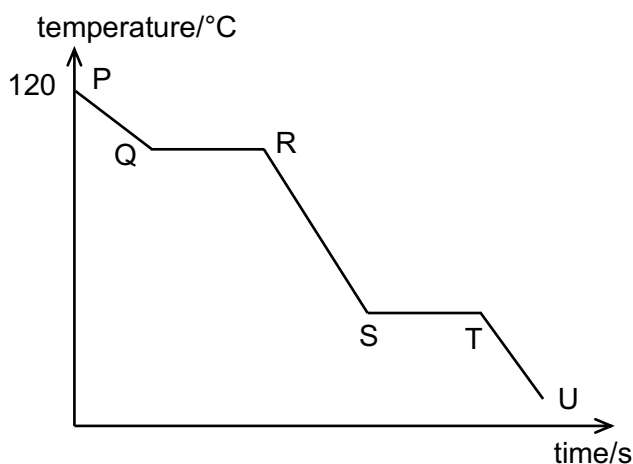
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 15.

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

- 1 The graph shows the change in temperature with time when steam is cooled from 120 °C.



Which of the following shows the correct change taking place between different points of the graph?

|          | points | change                                      |
|----------|--------|---------------------------------------------|
| <b>A</b> | P to Q | kinetic energy of particle remains constant |
| <b>B</b> | Q to R | water boiling                               |
| <b>C</b> | R to S | the volume of liquid is decreasing          |
| <b>D</b> | T to U | water freezing                              |

- 2 A mixture is formed when two or more substances are physically combined together.

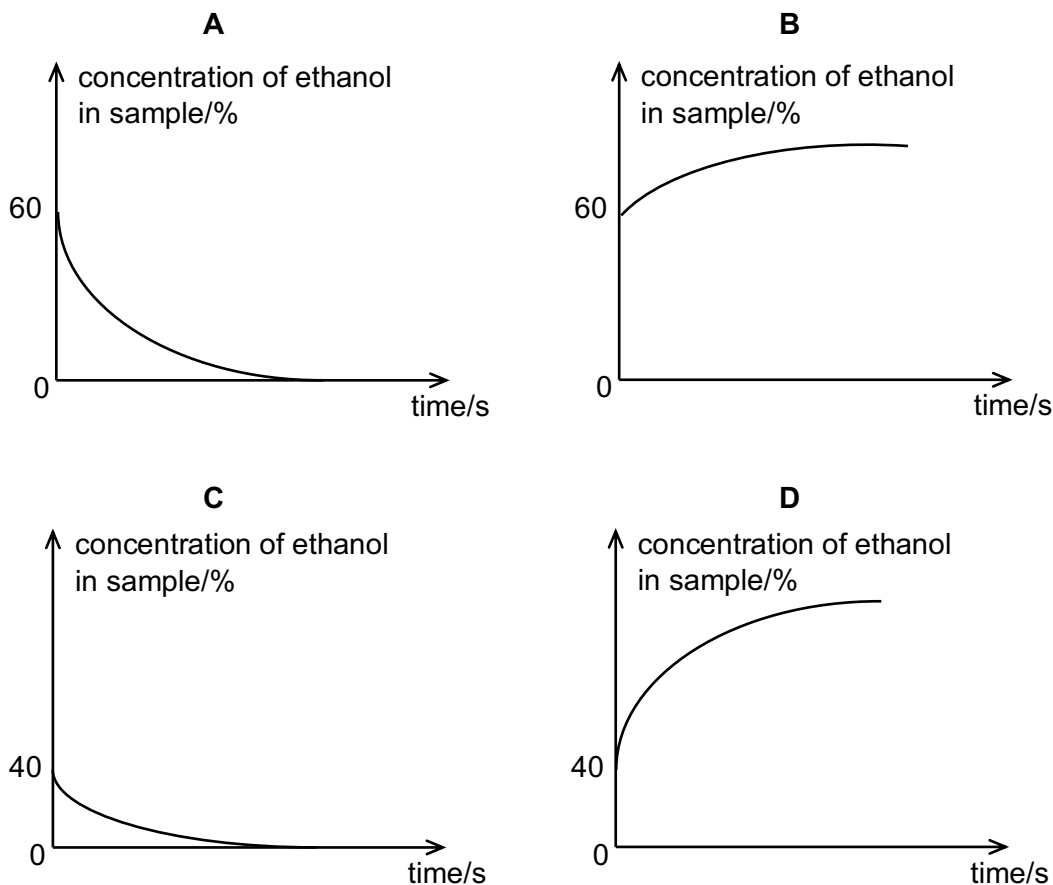
Which statement about mixtures is true?

- A** Equal masses of two substances must be used.
- B** The mixture shows similar chemical properties to those of its constituents.
- C** The substances must be both metals.
- D** When the substances are combined, an ionic or a covalent compound forms.
- 3 What is necessary for two substances to be separated by paper chromatography?
- A** They are both soluble in water.
- B** They have the same solubility in the same solvent.
- C** They have different solubilities in the same solvent.
- D** Their solids have different densities in the same solvent.

- 4 Whisky is a beverage composed of mainly water and ethanol. Scotch Whisky is usually made up of 60 % of ethanol by volume.

A sample of Scotch Whisky is distilled using fractional distillation. Ethanol boils at 78 °C.

Which graph shows the change in concentration of ethanol in the sample as the distillation proceeds?



- 5 Q is an element in the Periodic Table.

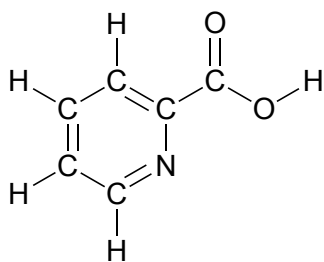
Which of the following represents an isotope of  ${}^{81}_{35}\text{Q}$ ?

- A  ${}^{79}_{33}\text{Q}$
- B  ${}^{79}_{35}\text{Q}$
- C  ${}^{81}_{42}\text{Q}$
- D  ${}^{81}_{46}\text{Q}$

- 6 Which ion has the lowest number of electron shells containing electrons?

- A  $\text{Al}^{3+}$
- B  $\text{Be}^{2+}$
- C  $\text{N}^{3-}$
- D  $\text{S}^{2-}$

- 7 The diagram shows a molecule of pyridine-2-carboxylic acid.



Determine the number of valence electrons involved in bonding and the number of valence electrons **not** involved in bonding in one molecule of pyridine-2-carboxylic acid.

|          | number of valence electrons<br>involved in bonding | number of valence electrons <b>not</b><br>involved in bonding |
|----------|----------------------------------------------------|---------------------------------------------------------------|
| <b>A</b> | 18                                                 | 10                                                            |
| <b>B</b> | 18                                                 | 46                                                            |
| <b>C</b> | 36                                                 | 10                                                            |
| <b>D</b> | 36                                                 | 20                                                            |

- 8 X, Y and Z are compounds of elements in Period 3. Their electrical conductivities are shown in the table below.

|                                                                                         | X                   | Y    | Z                   |
|-----------------------------------------------------------------------------------------|---------------------|------|---------------------|
| electrical conductivity of the<br>compound when molten                                  | good                | good | does not<br>conduct |
| electrical conductivity of the<br>mixture obtained upon adding<br>the compound to water | does not<br>conduct | good | does not<br>conduct |

What are the possible identities of X, Y and Z?

|          | X          | Y         | Z       |
|----------|------------|-----------|---------|
| <b>A</b> | $Al_2O_3$  | NaCl      | diamond |
| <b>B</b> | $Al_2O_3$  | Cu        | diamond |
| <b>C</b> | $Na_2SO_4$ | $Al_2O_3$ | NaCl    |
| <b>D</b> | $Na_2SO_4$ | Cu        | $Br_2$  |

- 9 Both hydrochloric acid and ethanoic acid have the same concentration of  $1.00 \text{ mol/dm}^3$ .

Which method(s) is/are suitable to test their strengths?

- 1 using universal indicator solution
- 2 measuring their electrical conductivity
- 3 titration using  $1.00 \text{ mol/dm}^3$  of aqueous sodium hydroxide

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

- 10 Which pair of solutions, when mixed together, forms a precipitate?

- A** sodium chloride and barium nitrate
- B** sodium nitrate and ammonium sulfate
- C** silver sulfate and nitric acid
- D** silver nitrate and hydrochloric acid

- 11 An aqueous solution containing a mixture of calcium ions, copper(II) ions and zinc ions was treated with an excess of aqueous ammonia. The reaction mixture was filtered.

What is the colour of the residue?

- A** white
- B** blue
- C** green
- D** no residue is obtained

- 12 256 g of sulfur vapor has the same volume as 160 g of bromine gas at the same temperature and pressure.

What is the formula of a molecule of sulfur?

**A**  $\text{S}_{16}$                       **B**  $\text{S}_8$                       **C**  $\text{S}_4$                       **D**  $\text{S}_2$

- 13 Which volume of  $0.1 \text{ mol/dm}^3$  sulfuric acid is required to react completely with  $50 \text{ cm}^3$  of  $0.2 \text{ mol/dm}^3$  lithium hydroxide solution?

**A**  $0.5 \text{ cm}^3$                       **B**  $1 \text{ cm}^3$                       **C**  $50 \text{ cm}^3$                       **D**  $100 \text{ cm}^3$

- 14 Which statement about the ions of Group II elements is correct?
- A They have two valence electrons.  
 B They contain an odd number of electrons.  
 C They contain more electrons than protons.  
 D They contain more protons than electrons.
- 15 Which pair of elements, when reacted together, gives the least violent reaction?
- A lithium and iodine  
 B rubidium and fluorine  
 C lithium and fluorine  
 D rubidium and iodine
- 16 An element R is in Group VII of the Periodic Table.  
 Which of the following formulae is **incorrect**?
- A  $R^-$                       B HR                      C  $R_2$                       D MgR

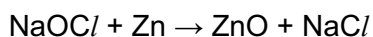
- 17 Which of the following shows the correct source and effect of the named pollutant?

|   | pollutant          | source                    | effect         |
|---|--------------------|---------------------------|----------------|
| A | methane            | combustion of fossil fuel | global warming |
| B | oxides of nitrogen | lightning activity        | acid rain      |
| C | ozone              | depletion of ozone layer  | acid rain      |
| D | sulfur dioxide     | volcanoes                 | global warming |

- 18 Which of the following gives the definitions of reduction?

|   | oxygen | hydrogen | electrons |
|---|--------|----------|-----------|
| A | loss   | gain     | gain      |
| B | loss   | loss     | gain      |
| C | gain   | gain     | loss      |
| D | gain   | loss     | loss      |

- 19 Sodium hypochlorite reacts with zinc metal to form zinc oxide and sodium chloride.

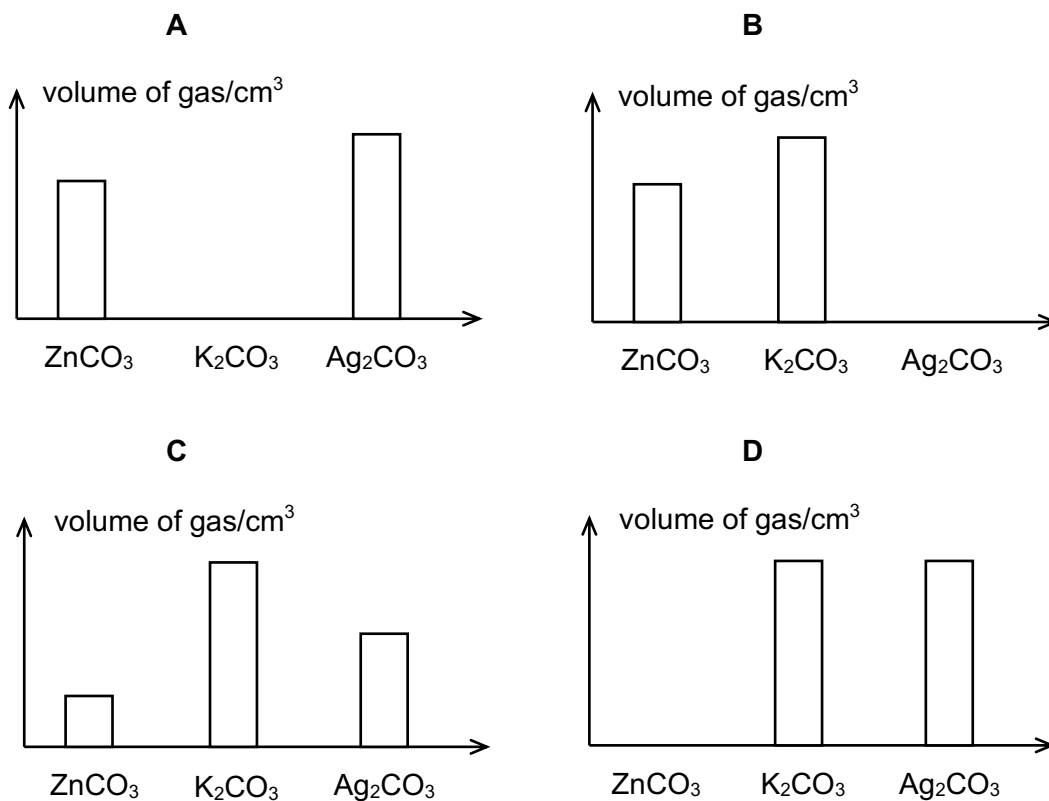


Which statement about this reaction is correct?

- A oxygen changes from oxidation state 0 to  $-2$
  - B chlorine changes from oxidation state  $+1$  to  $-1$
  - C sodium changes from oxidation state  $+3$  to  $+1$
  - D zinc remains in oxidation state 0
- 20 Iodine solution turns from brown to colourless when added to substance X.

Based on this observation, what can be deduced about substance X?

- A Substance X is an oxidising agent.
  - B Substance X is a reducing agent.
  - C Substance X is a bleaching agent.
  - D Substance X can only be aqueous sodium chloride.
- 21 The carbonates of zinc, potassium and silver were heated strongly.
- Which graph best shows the relative volume of gas collected in the first minute of the reaction?



**22** Which statement about alloys is always correct?

- A** Alloys contains only metallic atoms.
- B** Their structure contains a 'sea of electrons'.
- C** They have higher melting point than its pure metals.
- D** They have equal or better electrical conductivity than its pure metal.

**23** Metals are found naturally in its elemental state or as metallic compounds.

Metals can be extracted from their compounds through either electrolysis or using carbon as a reducing agent.

Which row is correct?

|          | exists as an element | obtained through electrolysis | obtained by reduction using carbon |
|----------|----------------------|-------------------------------|------------------------------------|
| <b>A</b> | Au                   | Na                            | Pb                                 |
| <b>B</b> | Mg                   | Na                            | Pb                                 |
| <b>C</b> | Au                   | Ag                            | Mg                                 |
| <b>D</b> | Mg                   | Ag                            | Ca                                 |

**24** Which of the following are reason(s) why iron is recycled?

- 1 Recycling scrap iron is cheaper than mining iron ores.
- 2 Recycling scrap metal reduces environmental problems arising from disposal of scrap metal in landfills.
- 3 Recycling iron reduces the amount of air pollutants released during extraction of iron.

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

**25** Which process is an exothermic process?

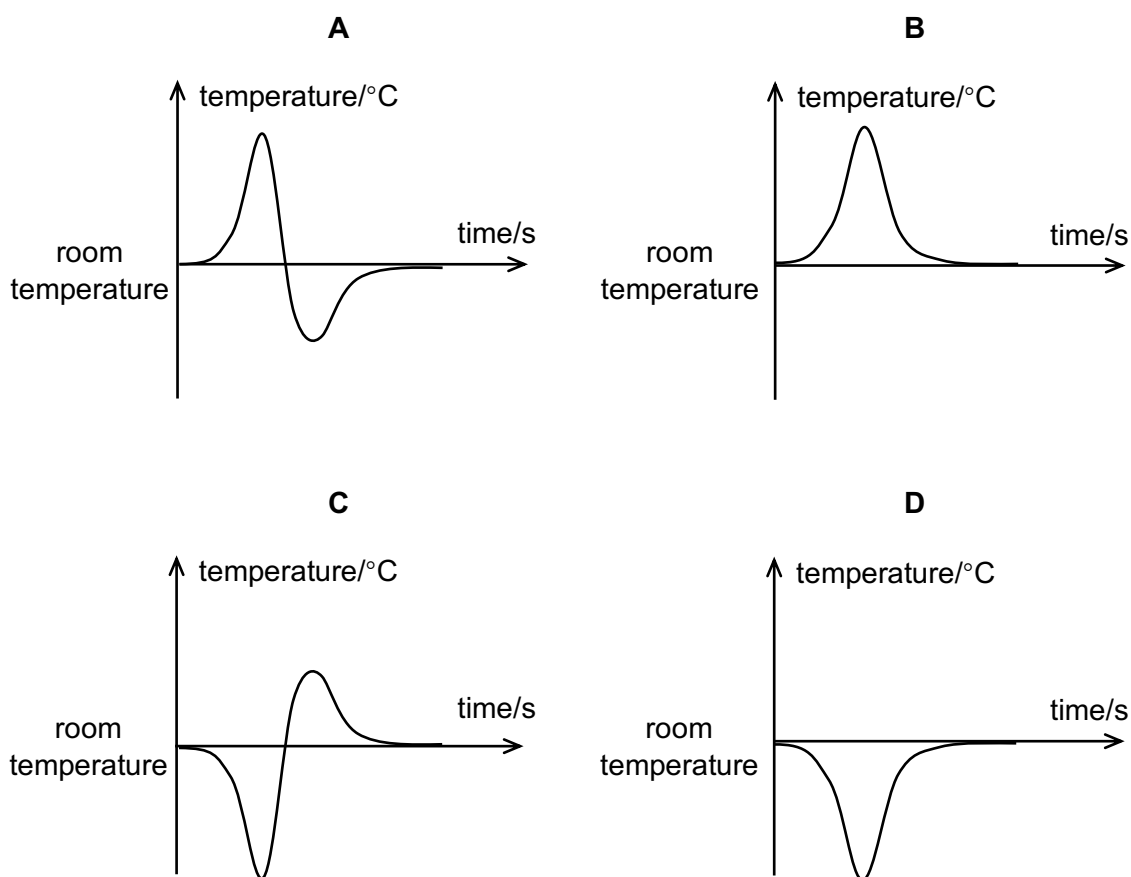
- A** photosynthesis
- B** sublimation of iodine
- C** dissolution of ammonium chloride in water
- D** formation of an oxygen molecule from two oxygen atoms



- 26 In a particular two-step chemical reaction, step 2 occurs immediately after step 1 is complete.

|        | sign of $\Delta H$ | energy change/kJ |
|--------|--------------------|------------------|
| step 1 | negative           | 200              |
| step 2 | positive           | 350              |

Which graph shows the temperature change that will occur for the two-step chemical reaction?



- 27 The enthalpy change of combustion,  $\Delta H_{\text{combustion}}$ , is the enthalpy change when one mole of substance is completely burned in oxygen gas.

Propane is used as a fuel for portable cookstoves and undergoes combustion according to the equation shown.



Calculate the energy released when 22 g of propane is burned.

- A      222 kJ      B      1110 kJ      C      2220 kJ      D      5550 kJ

- 28** On 24 February 2021, an explosion at an industrial building in Tuas killed three workers and injured seven others. The source of explosion was later found to be potato starch, which could have been ignited in the presence of a naked flame.

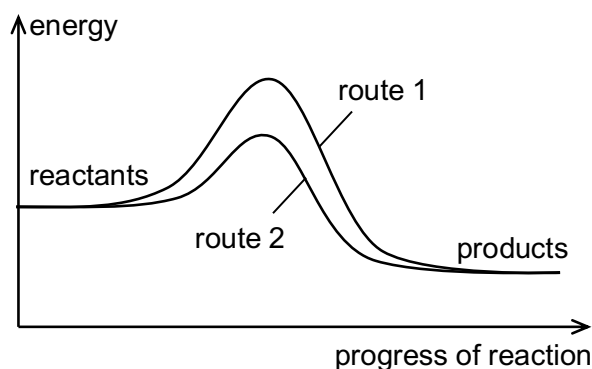
Which of the following statement(s) is/are possible explanation(s) why the potato starch resulted in an explosion?

- 1 Potato starch is a good conductor of heat which spreads fire quickly.
- 2 Potato starch has a large surface area which increases rate of combustion.
- 3 The presence of large number of potato starch particles per unit volume of air increases the rate of combustion.

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

- 29** The diagram shows the energy profile diagram for a reaction.

The original reaction proceeded by route 1. After the addition of substance F, the reaction proceeded by route 2.



What change is likely to be observed when F is added to the original reaction mixture?

- A** The reaction yields more products.  
**B** The reaction goes to completion faster.  
**C** The reaction becomes less exothermic.  
**D** The reaction becomes more exothermic.

- 30** A sealed container at 250 atm containing only ammonia gas was heated from room temperature to 450 °C.

Which gas(es) will be found in the container at 450 °C?

- A** ammonia only  
**B** ammonia and nitrogen only  
**C** hydrogen and nitrogen only  
**D** ammonia, hydrogen and nitrogen
- 31** In separate electrolysis experiments, the same amount of charge deposited 8 g of copper from copper(II) nitrate and 3 g of titanium from titanium nitrate.

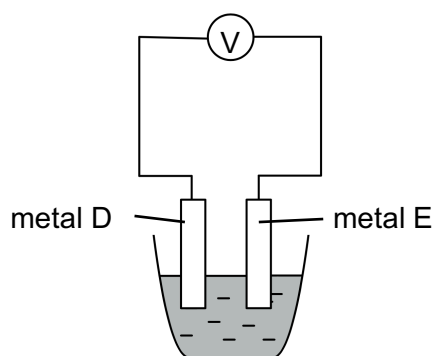
What is the charge on the titanium ion?

- A** 1+                      **B** 2+                      **C** 3+                      **D** 4+
- 32** Which pair of statements describes the differences between the conduction of electricity in the electrolyte and the conduction of electricity in a platinum electrode during electrolysis?

|   | conduction of electricity in electrolyte      | conduction of electricity in platinum electrode |
|---|-----------------------------------------------|-------------------------------------------------|
| 1 | current due to movement of ions               | current due to movement of ions and electrons   |
| 2 | charged particles move in opposite directions | charged particles move in a single direction    |
| 3 | results in a chemical change                  | does not result in a chemical change            |

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

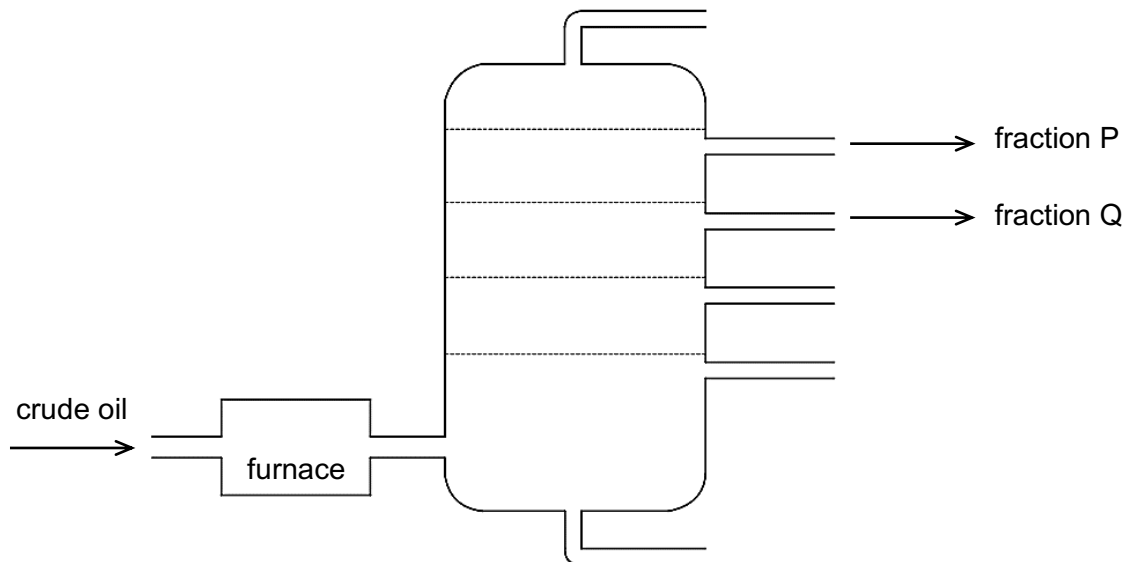
- 33 A simple cell was setup as shown in the diagram.



Which pair of metals will produce the highest voltage?

|          | metal D   | metal E   |
|----------|-----------|-----------|
| <b>A</b> | magnesium | lead      |
| <b>B</b> | magnesium | aluminium |
| <b>C</b> | silver    | copper    |
| <b>D</b> | silver    | magnesium |

- 34 The diagram shows the fractional distillation of crude oil.

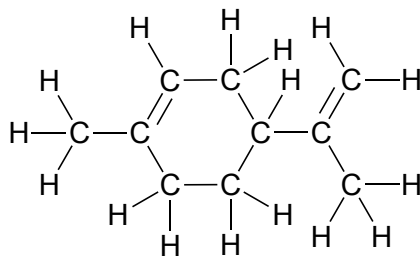


Which of the following properties of fraction P and Q is correct?

|          | properties of P and Q                   |                            |
|----------|-----------------------------------------|----------------------------|
| <b>A</b> | P has longer hydrocarbon chains than Q  | P burns less easily than Q |
| <b>B</b> | P has a high boiling point than Q       | P burns more easily than Q |
| <b>C</b> | P has shorter hydrocarbon chains than Q | P burns less easily than Q |
| <b>D</b> | P has a lower boiling point than Q      | P burns more easily than Q |

- 35 Liquid limonene,  $C_{10}H_{16}$ , can be extracted from lemon peels.

The structure of limonene is given below.

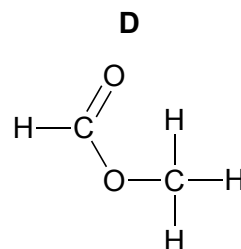
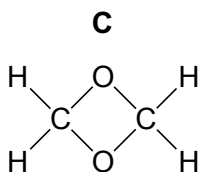
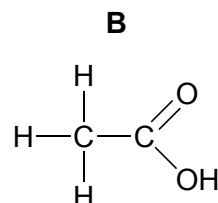
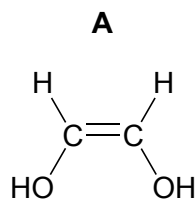


How many moles of bromine will react with 68 g of limonene?

- A 0.5 mol
  - B 1 mol
  - C 8 mol
  - D 10 mol
- 36 The hydrocarbon  $CH_3CH_2CH=CH_2$  can undergo a number of chemical reactions.
- In which reaction will the carbon–carbon single bond(s) be broken?
- A addition polymerisation
  - B addition of steam
  - C combustion
  - D hydrogenation
- 37 Which statement about fermentation is correct?
- A Fermentation converts hydrocarbon to ethanol and liberates carbon dioxide.
  - B Fermentation converts hydrocarbon to ethanol and liberates carbon monoxide.
  - C Fermentation converts carbohydrate to ethanol and liberates carbon dioxide.
  - D Fermentation converts carbohydrate to ethanol and liberates carbon monoxide.

- 38 An aqueous solution of a compound with molecular formula  $C_2H_4O_2$  reacts with magnesium metal to form a gas which extinguishes a lighted splint.

What is the structural formula of the compound?



- 39 Which of the following product is formed when methanol reacts with ethanoic acid?

- A** ethyl methanoate
- B** methyl ethanoate
- C** propanal
- D** propanoate acid

- 40 Which statement about macromolecules is correct?

- A** Nylon and *Terylene* are both polyesters.
- B** Nylon and *Terylene* are made from the same monomers.
- C** Nylon and proteins are formed via addition polymerisation.
- D** The amide linkages in proteins are the same as those in nylon.

# The Periodic Table of Elements

| Group                                                                                                |                                           |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             |                                           |                                           |                                           |                                             |                                            |                                         |                                      |  |
|------------------------------------------------------------------------------------------------------|-------------------------------------------|------------------------------------------|-----------------------------------------------|-------------------------------------------|--------------------------------------------|-------------------------------------------|--------------------------------------------|--------------------------------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|---------------------------------------------|--------------------------------------------|-----------------------------------------|--------------------------------------|--|
| I                                                                                                    | II                                        |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             | III                                       | IV                                        | V                                         | VI                                          | VII                                        | 0                                       |                                      |  |
| <div>Key</div> <div>proton (atomic) number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                           |                                          |                                               |                                           |                                            | <div>1<br/>H<br/>hydrogen<br/>1</div>     |                                            |                                            |                                              |                                             |                                             |                                           |                                           |                                           |                                             |                                            |                                         | <div>2<br/>He<br/>helium<br/>4</div> |  |
|                                                                                                      |                                           |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             |                                           |                                           |                                           |                                             |                                            |                                         |                                      |  |
|                                                                                                      |                                           |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             |                                           |                                           |                                           |                                             |                                            |                                         |                                      |  |
| <div>3<br/>Li<br/>lithium<br/>7</div>                                                                | <div>4<br/>Be<br/>beryllium<br/>9</div>   |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             | <div>5<br/>B<br/>boron<br/>11</div>       | <div>6<br/>C<br/>carbon<br/>12</div>      | <div>7<br/>N<br/>nitrogen<br/>14</div>    | <div>8<br/>O<br/>oxygen<br/>16</div>        | <div>9<br/>F<br/>fluorine<br/>19</div>     | <div>10<br/>Ne<br/>neon<br/>20</div>    |                                      |  |
| <div>11<br/>Na<br/>sodium<br/>23</div>                                                               | <div>12<br/>Mg<br/>magnesium<br/>24</div> |                                          |                                               |                                           |                                            |                                           |                                            |                                            |                                              |                                             |                                             | <div>13<br/>Al<br/>aluminium<br/>27</div> | <div>14<br/>Si<br/>silicon<br/>28</div>   | <div>15<br/>P<br/>phosphorus<br/>31</div> | <div>16<br/>S<br/>sulfur<br/>32</div>       | <div>17<br/>Cl<br/>chlorine<br/>35.5</div> | <div>18<br/>Ar<br/>argon<br/>40</div>   |                                      |  |
| <div>19<br/>K<br/>potassium<br/>39</div>                                                             | <div>20<br/>Ca<br/>calcium<br/>40</div>   | <div>21<br/>Sc<br/>scandium<br/>45</div> | <div>22<br/>Ti<br/>titanium<br/>48</div>      | <div>23<br/>V<br/>vanadium<br/>51</div>   | <div>24<br/>Cr<br/>chromium<br/>52</div>   | <div>25<br/>Mn<br/>manganese<br/>55</div> | <div>26<br/>Fe<br/>iron<br/>56</div>       | <div>27<br/>Co<br/>cobalt<br/>59</div>     | <div>28<br/>Ni<br/>nickel<br/>59</div>       | <div>29<br/>Cu<br/>copper<br/>64</div>      | <div>30<br/>Zn<br/>zinc<br/>65</div>        | <div>31<br/>Ga<br/>gallium<br/>70</div>   | <div>32<br/>Ge<br/>germanium<br/>73</div> | <div>33<br/>As<br/>arsenic<br/>75</div>   | <div>34<br/>Se<br/>selenium<br/>79</div>    | <div>35<br/>Br<br/>bromine<br/>80</div>    | <div>36<br/>Kr<br/>krypton<br/>84</div> |                                      |  |
| <div>37<br/>Rb<br/>rubidium<br/>85</div>                                                             | <div>38<br/>Sr<br/>strontium<br/>88</div> | <div>39<br/>Y<br/>yttrium<br/>89</div>   | <div>40<br/>Zr<br/>zirconium<br/>91</div>     | <div>41<br/>Nb<br/>niobium<br/>93</div>   | <div>42<br/>Mo<br/>molybdenum<br/>96</div> | <div>43<br/>Tc<br/>technetium<br/>-</div> | <div>44<br/>Ru<br/>ruthenium<br/>101</div> | <div>45<br/>Rh<br/>rhodium<br/>103</div>   | <div>46<br/>Pd<br/>palladium<br/>106</div>   | <div>47<br/>Ag<br/>silver<br/>108</div>     | <div>48<br/>Cd<br/>cadmium<br/>112</div>    | <div>49<br/>In<br/>indium<br/>115</div>   | <div>50<br/>Sn<br/>tin<br/>119</div>      | <div>51<br/>Sb<br/>antimony<br/>122</div> | <div>52<br/>Te<br/>tellurium<br/>128</div>  | <div>53<br/>I<br/>iodine<br/>127</div>     | <div>54<br/>Xe<br/>xenon<br/>131</div>  |                                      |  |
| <div>55<br/>Cs<br/>caesium<br/>133</div>                                                             | <div>56<br/>Ba<br/>barium<br/>137</div>   | <div>57–71<br/>lanthanoids</div>         | <div>72<br/>Hf<br/>hafnium<br/>178</div>      | <div>73<br/>Ta<br/>tantalum<br/>181</div> | <div>74<br/>W<br/>tungsten<br/>184</div>   | <div>75<br/>Re<br/>rhenium<br/>186</div>  | <div>76<br/>Os<br/>osmium<br/>190</div>    | <div>77<br/>Ir<br/>iridium<br/>192</div>   | <div>78<br/>Pt<br/>platinum<br/>195</div>    | <div>79<br/>Au<br/>gold<br/>197</div>       | <div>80<br/>Hg<br/>mercury<br/>201</div>    | <div>81<br/>Tl<br/>thallium<br/>204</div> | <div>82<br/>Pb<br/>lead<br/>207</div>     | <div>83<br/>Bi<br/>bismuth<br/>209</div>  | <div>84<br/>Po<br/>polonium<br/>-</div>     | <div>85<br/>At<br/>astatine<br/>-</div>    | <div>86<br/>Rn<br/>radon<br/>-</div>    |                                      |  |
| <div>87<br/>Fr<br/>francium<br/>-</div>                                                              | <div>88<br/>Ra<br/>radium<br/>-</div>     | <div>89–103<br/>actinoids</div>          | <div>104<br/>Rf<br/>Rutherfordium<br/>-</div> | <div>105<br/>Db<br/>dubnium<br/>-</div>   | <div>106<br/>Sg<br/>seaborgium<br/>-</div> | <div>107<br/>Bh<br/>bohrium<br/>-</div>   | <div>108<br/>Hs<br/>hassium<br/>-</div>    | <div>109<br/>Mt<br/>meitnerium<br/>-</div> | <div>110<br/>Ds<br/>darmstadtium<br/>-</div> | <div>111<br/>Rg<br/>roentgenium<br/>-</div> | <div>112<br/>Cn<br/>copernicium<br/>-</div> |                                           | <div>114<br/>Fl<br/>flavorium<br/>-</div> |                                           | <div>116<br/>Lv<br/>livermorium<br/>-</div> |                                            |                                         |                                      |  |

lanthanoids

actinoids

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

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