



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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CHEMISTRY

0620/13

Paper 1 Multiple Choice

October/November 2013

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, highlighters, 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 20.

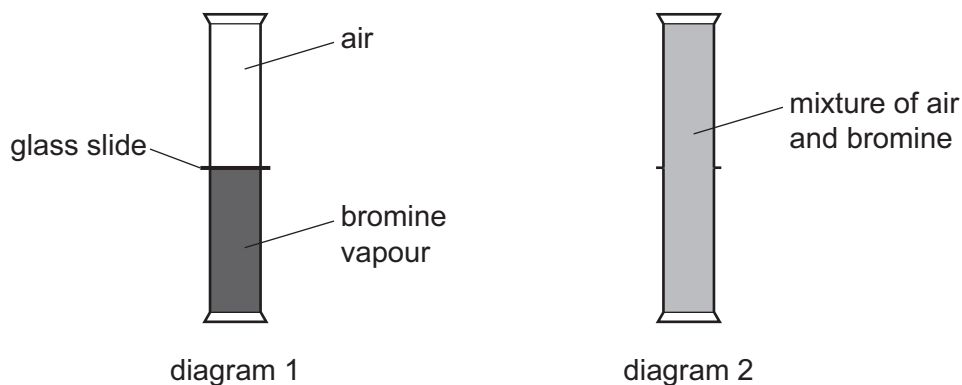
Electronic calculators may be used.

This document consists of **19** printed pages and **1** blank page.



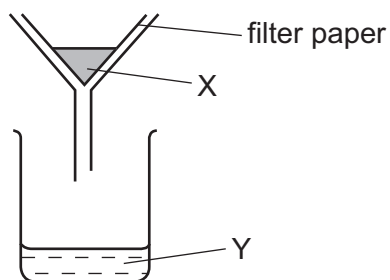
- 1 A gas jar of bromine vapour and a gas jar of air are set up as shown in diagram 1.

The glass slide is removed. Diagram 2 shows the appearance of the gas jars after one hour.



Which statement explains why the bromine and air mix together?

- A Bromine is denser than air.
 - B Bromine is lighter than air.
 - C Bromine molecules moved upwards and molecules in air moved downwards.
 - D Molecules in bromine and air moved randomly.
- 2 The diagram shows a method for separating a substance that contains X and Y.



Which types of substance can be separated as shown?

- A compounds
- B elements
- C mixtures
- D molecules

3 Diagram 1 shows the paper chromatogram of substance X.

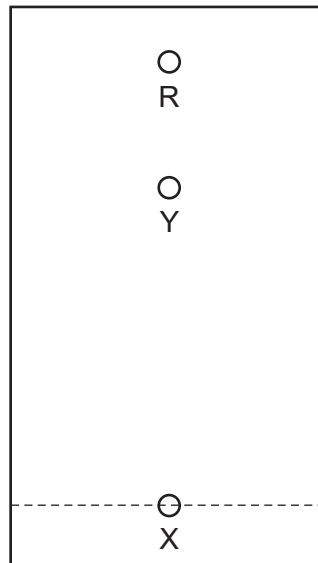


diagram 1

Diagram 2 shows the cooling curve for substance Y.

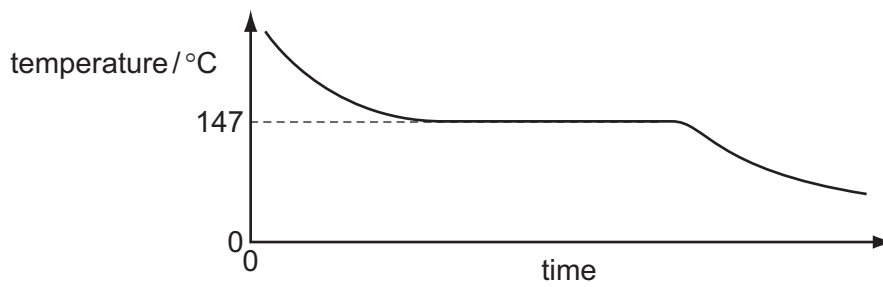


diagram 2

Which statement about X and Y is correct?

- A** X is a mixture and Y is a pure substance.
- B** X is a pure substance and Y is a mixture.
- C** X and Y are mixtures.
- D** X and Y are pure substances.

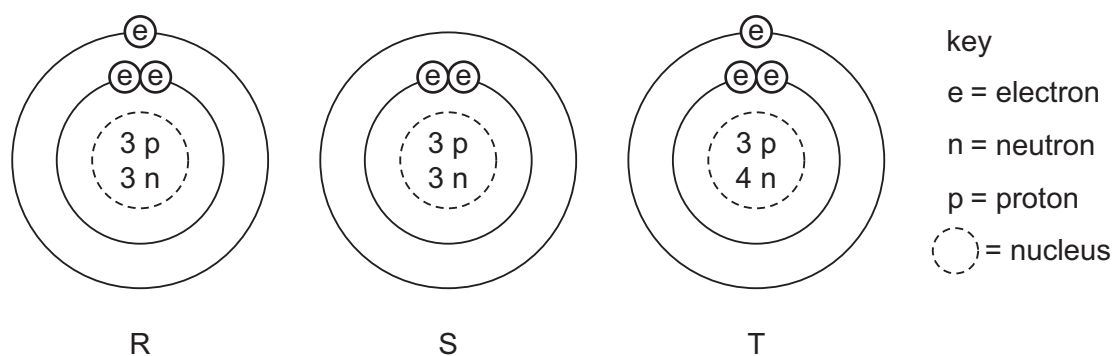
4 The atomic structures of four atoms are shown.

| atom | number of neutrons | number of protons | number of electrons |
|------|--------------------|-------------------|---------------------|
| W | 6 | 6 | 6 |
| X | 7 | 7 | 7 |
| Y | 8 | 6 | 6 |
| Z | 8 | 8 | 8 |

Which pair of atoms are isotopes?

- A** W and X **B** W and Y **C** X and Y **D** Y and Z

5 The diagram shows the structure of three particles, R, S and T.



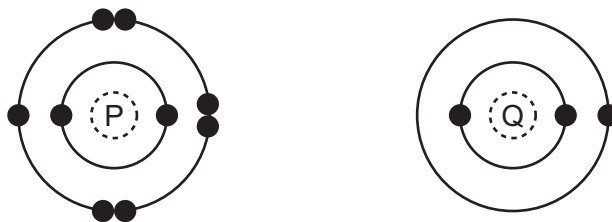
Which row describes these particles?

| | ions | isotopes |
|----------|---------|----------|
| A | R | S and T |
| B | R and S | T |
| C | S | R and T |
| D | T | R and S |

6 Which statement about the bonding in a molecule of water is **not** correct?

- A** Both hydrogen and oxygen have a noble gas configuration of electrons.
B Each hydrogen shares its one electron with oxygen.
C Oxygen shares one of its own electrons with each hydrogen.
D Oxygen shares two of its own electrons with each hydrogen.

7 The electronic structures of atoms P and Q are shown.



P and Q react to form an ionic compound.

What is the formula of the compound?

- A** Q_7P **B** QP **C** QP_3 **D** QP_7

8 A solid mixture contains an ionic salt, X, and a covalent organic compound, Y.

Two students suggest methods of separating the mixture as shown.

method 1

shake with water

X + Y

method 2

shake with ethanol

X + Y

Which methods of separation are likely to work?

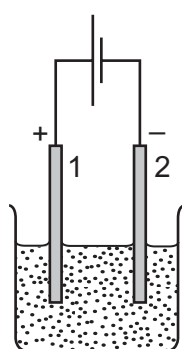
| | 1 | 2 |
|----------|---|---|
| A | ✓ | ✓ |
| B | ✓ | x |
| C | x | ✓ |
| D | x | x |

9 Which relative molecular mass, M_r , is **not** correct for the molecule given?

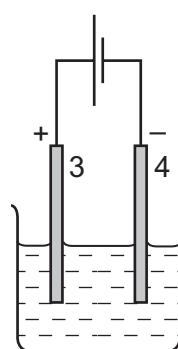
| | molecule | M_r |
|----------|-------------------------------|-------|
| A | ammonia, NH_3 | 17 |
| B | carbon dioxide, CO_2 | 44 |
| C | methane, CH_4 | 16 |
| D | oxygen, O_2 | 16 |

10 Two electrolysis experiments were carried out as shown in the diagram below.

The graphite electrodes are labelled 1-4.



molten
sodium chloride



concentrated aqueous
sodium chloride

Which row describes the products at the electrodes in these experiments?

| | electrode 1 | electrode 2 | electrode 3 | electrode 4 |
|----------|-------------|-------------|-------------|-------------|
| A | chlorine | hydrogen | chlorine | hydrogen |
| B | chlorine | sodium | chlorine | hydrogen |
| C | chlorine | sodium | hydrogen | chlorine |
| D | sodium | chlorine | sodium | chlorine |

11 One molten compound and two aqueous solutions were electrolysed.

The table gives the compounds electrolysed and the electrodes used.

| | substance electrolysed | electrodes |
|---|--------------------------------|------------|
| 1 | concentrated hydrochloric acid | carbon |
| 2 | concentrated sodium chloride | platinum |
| 3 | molten lead bromide | platinum |

In which experiments is a gas evolved at the cathode?

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

12 When ammonium nitrate is added to water the temperature of the water decreases.

The ammonium nitrate can be recovered by evaporating the water added.

Which explains these observations?

- A** The ammonium nitrate dissolves in the water and the process is endothermic.
B The ammonium nitrate reacts with the water and the process is endothermic.
C The ammonium nitrate dissolves in the water and the process is exothermic.
D The ammonium nitrate reacts with the water and the process is exothermic.

13 Which substance could **not** be used as a fuel to heat water in a boiler?

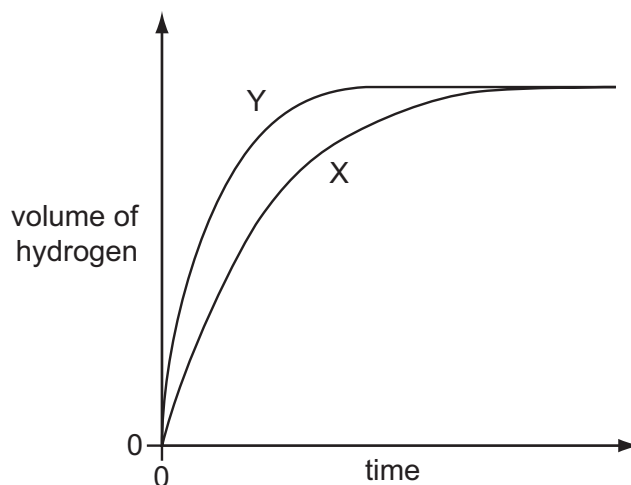
- A** ethanol
B hydrogen
C methane
D oxygen

14 Which substance is not a fossil fuel?

- A** coal **B** kerosene **C** gasoline **D** wood

15 A student investigates the rate of reaction between zinc and an excess of sulfuric acid.

The graph shows the results of two experiments, X and Y.



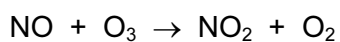
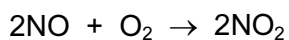
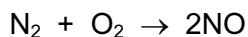
Which change explains the difference between X and Y?

- A A catalyst is added in Y.
 - B A lower temperature is used in Y.
 - C Larger pieces of zinc are used in Y.
 - D Less concentrated acid is used in Y.
- 16 When green iron(II) sulfate is heated, it turns white and a colourless liquid is produced. When the liquid is put back into the white solid it changes back to green.

What type of reaction takes place and what is the name of the liquid?

| | type of reaction | name of liquid |
|----------|------------------|----------------|
| A | redox | sulfuric acid |
| B | redox | water |
| C | reversible | sulfuric acid |
| D | reversible | water |

17 The reactions shown may occur in the air during a thunder storm.



Which row shows what happens to the reactant molecules in each of these reactions?

| | N_2 | NO | O_3 |
|----------|--------------|----------|--------------|
| A | oxidised | oxidised | oxidised |
| B | oxidised | oxidised | reduced |
| C | reduced | reduced | oxidised |
| D | reduced | reduced | reduced |

18 Which are properties of an acid?

1 reacts with ammonium sulfate to form ammonia

2 turns red litmus blue

| | 1 | 2 |
|----------|---|---|
| A | ✓ | ✓ |
| B | ✓ | x |
| C | x | ✓ |
| D | x | x |

19 Which of the following are properties of the oxides of non-metals?

| | property 1 | property 2 |
|----------|------------|------------|
| A | acidic | covalent |
| B | acidic | ionic |
| C | basic | covalent |
| D | basic | ionic |

- 20 The cations shown are identified by the colour of the precipitates formed when an excess of an aqueous solution of X is added.

| cations present | effect of adding an excess of aqueous X |
|---------------------------------|---|
| iron(II) (Fe^{2+}) | green precipitate |
| copper(II) (Cu^{2+}) | light blue precipitate |
| iron(III) (Fe^{3+}) | red-brown precipitate |

What is X?

- A ammonia
 B limewater
 C silver nitrate
 D sodium hydroxide
- 21 Calcium, on the left of Period 4 of the Periodic Table, is more metallic than bromine on the right of this period.

Why is this?

Calcium has

- A fewer electrons.
 B fewer protons.
 C fewer full shells of electrons.
 D fewer outer shell electrons.
- 22 The diagrams show the labels of four bottles.

Which label is **not** correct?

| A | B | C | D |
|--|---|--|--|
| Bromine Br_2 Harmful liquid. Do not spill. | Iodine I_2 Danger Avoid breathing vapour from the solid. | Potassium K Danger Store under water. | Sodium Na Danger Store under oil. |

26 The list gives the order of some metals (and hydrogen) in the reactivity series.

Metal X is also included:

Most reactive K
 Mg
 Zn
 (H)
 X
 Least reactive Cu

Which row correctly shows the properties of metal X?

| | reacts with dilute acids | oxide reduced by carbon |
|----------|--------------------------|-------------------------|
| A | no | no |
| B | no | yes |
| C | yes | no |
| D | yes | yes |

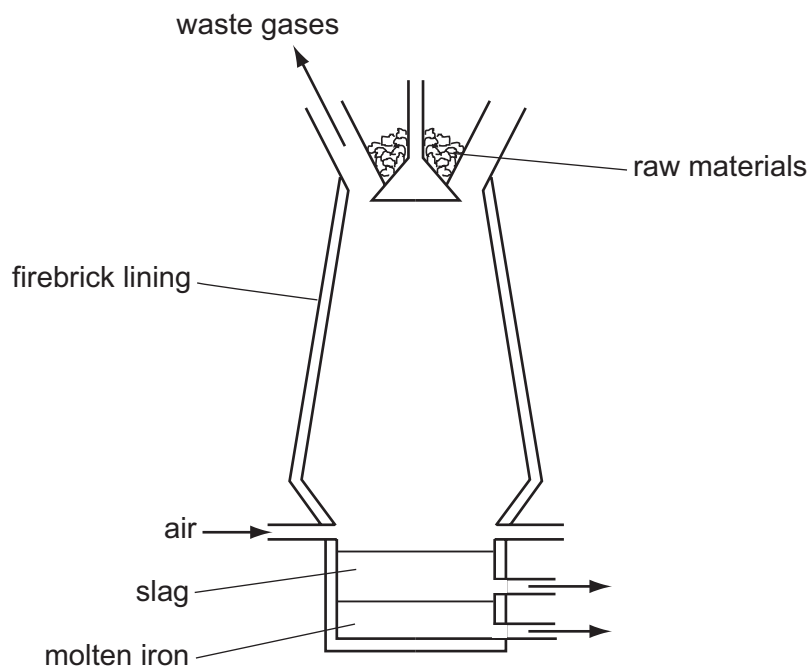
27 A new bicycle is being developed.
 Two different materials are used in its construction, both of which must be corrosion resistant.



Which two metals could be used?

- A** aluminium and mild steel
- B** aluminium and stainless steel
- C** mild steel and pure iron
- D** pure iron and stainless steel

28 Iron is extracted from hematite in the Blast Furnace.



The hematite contains silica as an impurity.

What reacts with this impurity to remove it?

- A calcium oxide
 - B carbon
 - C carbon dioxide
 - D oxygen
- 29 In which process is carbon dioxide **not** formed?
- A burning of natural gas
 - B fermentation
 - C heating lime
 - D respiration

30 Carbon dioxide is produced when

X reacts with ethanol.

Y reacts with sodium carbonate.

What are X and Y?

| | X | Y |
|----------|----------------|------|
| A | H ₂ | HCl |
| B | H ₂ | NaOH |
| C | O ₂ | HCl |
| D | O ₂ | NaOH |

31 A sample of fertiliser is tested by warming it with aqueous sodium hydroxide.

A colourless gas is produced which turns red litmus paper blue.

Which element, essential for plant growth, must be present?

- A** nitrogen
- B** phosphorus
- C** potassium
- D** sulfur

32 Iron rusts. This process involves the1..... of iron. Rusting can be prevented by covering the iron with grease or paint which stops2..... from reaching the surface of the iron.

Which words correctly complete gaps 1 and 2?

| | 1 | 2 |
|----------|-----------|----------|
| A | oxidation | nitrogen |
| B | oxidation | oxygen |
| C | reduction | nitrogen |
| D | reduction | oxygen |

33 Oxides of nitrogen are given out from car exhausts.

Which row best shows why oxides of nitrogen are unwanted?

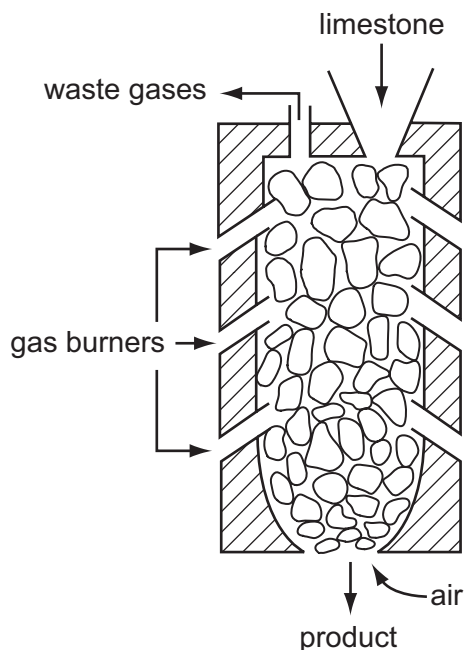
| | acidic | toxic |
|----------|--------|-------|
| A | no | no |
| B | no | yes |
| C | yes | no |
| D | yes | yes |

34 Water is treated at a water works to make it fit to drink.

What is present in the water when it leaves the waterworks?

- A** bacteria only
- B** bacteria and insoluble substances
- C** chlorine only
- D** chlorine and soluble substances

35 The diagram shows a kiln used to heat limestone.



What is the product and what waste gas is formed?

| | product | waste gas |
|----------|----------------------------------|-----------------|
| A | lime, CaO | carbon monoxide |
| B | lime, CaO | carbon dioxide |
| C | slaked lime, Ca(OH) ₂ | carbon monoxide |
| D | slaked lime, Ca(OH) ₂ | carbon dioxide |

36 Molecule X is both an alkene and a carboxylic acid.

Which row describes X?

| | saturated | -COOH present |
|----------|-----------|---------------|
| A | no | no |
| B | no | yes |
| C | yes | no |
| D | yes | yes |

37 Which hydrocarbon reacts with steam to produce ethanol?

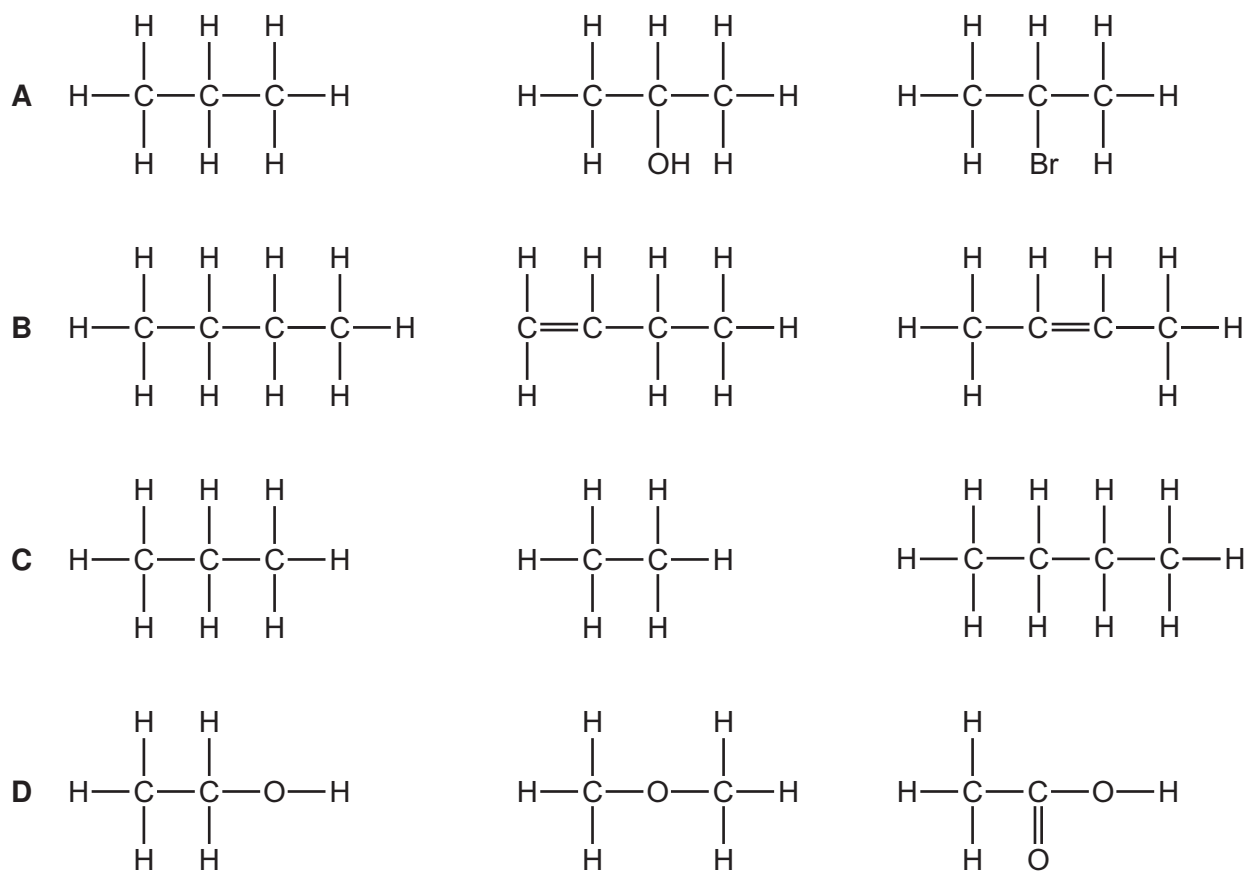
- A** C₂H₄ **B** C₂H₆ **C** C₃H₆ **D** C₃H₈

38 Petroleum is a mixture of different hydrocarbons.

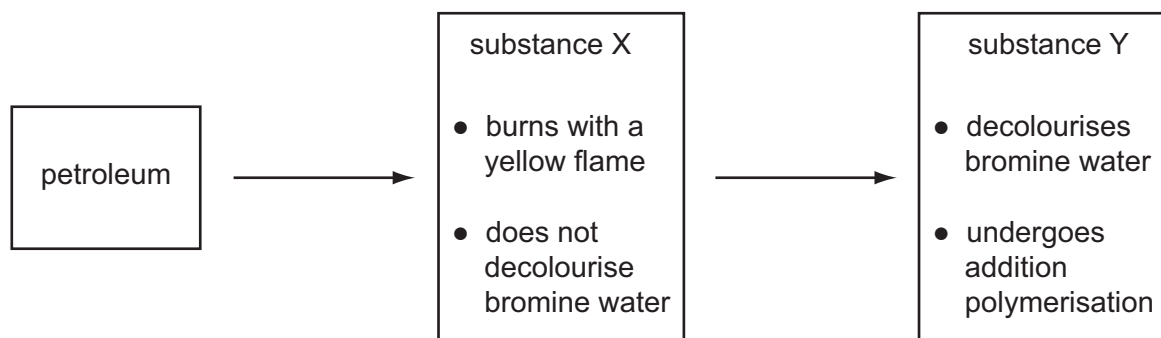
Which process is used to separate the petroleum into groups of similar hydrocarbons?

- A combustion
- B cracking
- C fractional distillation
- D reduction

39 Which row represents compounds in the same homologous series?



40 The diagram shows a flow diagram.



Which type of organic compounds are X and Y?

| | substance X | substance Y |
|----------|-------------|-------------|
| A | alcohol | alkane |
| B | alkane | alkene |
| C | alkene | alkane |
| D | alkane | alcohol |

DATA SHEET

The Periodic Table of the Elements

| Group | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|------------------------------------|---------------------------------------|------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|----------------------------------|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|--|--|--|--|-------------------------------|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | 0 | | | | | |
| | | | | | | | | | | | 1 H Hydrogen 1 | | | | | | | | | | | 4 He Helium 2 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 | | | | | |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 | | | | | |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 | | | | | |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | 96 Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 | | | | | |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | 210 Po Polonium 84 | 210 At Astatine 85 | 210 Rn Radon 86 | | | | | |
| 87 Fr Francium 87 | 226 Ra Radium 88 | 227 Ac Actinium 89 † | | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|-----------------------------------|--|-------------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|------------------------------------|--|-------------------------------------|---------------------------------------|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | 147 Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | 234 Pa Protactinium 91 | 238 U Uranium 92 | 237 Np Neptunium 93 | 244 Pu Plutonium 94 | 247 Am Americium 95 | 251 Cm Curium 96 | 252 Bk Berkelium 97 | 259 Cf Californium 98 | 261 Es Einsteinium 99 | 267 Fm Fermium 100 | 271 Md Mendelevium 101 | 285 No Nobelium 102 | 289 Lr Lawrencium 103 |

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

| | |
|---|----------------------------|
| a | a = relative atomic mass |
| X | X = atomic symbol |
| b | b = proton (atomic) number |

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