1 The apparatus shows the diffusion of 3 gases. Two beakers containing gas R were placed over two porous pots containing gases P and Q as shown.



What is the relative molecular masses of gases P, Q and R in ascending order?

	Lowest		Highest
Α	Q	Р	R
В	Q	R	Р
С	Р	R	Q
D	Р	Q	R

An impure sample of gas Y contains some water vapour and an impurity that is soluble 2 in water. Gas Y is insoluble in water and less dense than air.

Which of the following is the correct order for the apparatus to be joined together to collect a pure, dry sample of gas Y?



Α	1, 4, 2
В	1, 4, 3
-	

- С 4, 1, 2 D
- 4, 1, 3

**3** Ethanol and butanol have boiling points of 78°C and 118°C respectively. The apparatus shown is used to distil ethanol from a mixture of ethanol and butanol.



Which graph shows the change in the concentration of ethanol in flask  ${\bf F}$  as the distillation proceeds?



4 The chromatogram of a sweet is shown in the diagram.

solvent front	red	blue	start line

Which of the following statements can be deduced from the chromatogram?

- A The sweet is blue in colour.
- **B** The red dye is more soluble than the blue dye.
- **C** The molecules of the blue dye are heavier than that of the red dye.
- **D** The R<sub>f</sub> value of the blue dye is greater than that of the red dye.

5 The models and formulae for two molecules are shown.



Which is the correct model for a molecule of the compound formed between X and Z?



6 Element X is found in the Periodic Table with atomic number **p**. It forms an ionic oxide,  $X_2O$ . Element Y has atomic number **p**+3.

What is the formula of the oxide of Y?

- A YO
- B YO<sub>2</sub>
- C Y<sub>2</sub>O
- $D Y_2O_3$
- 7 The formation of metallic chlorides involves the transfer of electrons from a metal atom to chlorine atoms.

In the formation of one mole of which metallic chloride do the metal atoms **not** transfer exactly two moles of electrons?

- A barium chloride
- B iron (II) chloride
- **C** magnesium chloride
- **D** sodium chloride

8 The table shows information about particles **R** and **S**.

	Number of		
Particle	protons	neutrons	electrons
R	11	12	10
S	19	20	18

Which of the following statement is correct for both **R** and **S**?

- **A** Both are atoms in the same Group.
- **B** Both are isotopes of the same element.
- **C** Both are positive ions in the same Group.
- **D** Both are positive ions in different Groups.
- **9** The diagram shows the structural formula of the covalent molecule hydrogen peroxide.



Consider all the electrons in a molecule of hydrogen peroxide.

Which statement is true of the number of electrons in the molecule?

	Total number of electrons involved in bonding	Total number of electrons NOT involved in bonding
Α	4	4
В	6	6
С	4	8
D	6	12

**10** The table gives information on the ability of four substances to conduct electricity.

Substance	Property
w	Does not conduct under any conditions
Х	Conducts only in aqueous solution
Y	Conducts in both the molten and solid states
Z	Conducts in both the molten and aqueous states

What could these four substances be?

	W	Х	Y	Z
Α	HCI	S	KBr	Fe
В	Fe	HCI	KBr	S
С	S	KBr	Fe	HCI
D	S	HCI	Fe	KBr

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- 11 Which of the following represents 0.25 mol of chlorine gas at r.t.p.?
  - **A** 8.88 g
  - **B** 177.5 g
  - **C**  $0.25 \times 10^{23}$  molecules
  - **D**  $1.5 \times 10^{23}$  molecules
- **12** Melanin is a plastic containing 28.6% carbon, 4.8% hydrogen and 66.6% nitrogen by mass.

If its relative molecular mass is 126, what is its molecular formula?

- A CH<sub>2</sub>N<sub>2</sub>
- **B** C<sub>2</sub>H<sub>4</sub>N<sub>4</sub>
- **C** C<sub>3</sub>H<sub>6</sub>N<sub>6</sub>
- **D** C<sub>4</sub>H<sub>8</sub>N<sub>8</sub>
- 13 Reactions 1, 2 and 3 are used in the manufacture of three fertilisers which are underlined.

Reaction 1:  $H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$ Reaction 2:  $2H_2SO_4 + Ca_3(PO_4)_2 \rightarrow \underline{Ca(H_2PO_4)_2} + 2CaSO_4$ Reaction 3:  $3H_2SO_4 + Ca_3(PO_4)_2 + 6NH_3 \rightarrow \underline{2(NH_4)_3PO_4} + 3CaSO_4$ 

The relative molecular mass,  $M_r$ , of sulfuric acid and of each fertiliser is shown in the table.

	H <sub>2</sub> SO <sub>4</sub>	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	Ca(H <sub>2</sub> PO <sub>4</sub> ) <sub>2</sub>	(NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub>
Mr	98	132	234	149

In each reaction, 98 g of sulfuric acid was used.

Which reaction gave the greatest and least mass of fertiliser?

	Greatest mass	Least mass
Α	1	3
В	1	2
С	2	1
D	3	2

- **14** The following statements about dilute sulfuric acid are all correct.
  - 1 A white precipitate is formed when aqueous barium chloride is added.
  - 2 The solution turns anhydrous copper(II) sulfate from white to blue.
  - **3** Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
  - 4 The solution reacts with copper(II) oxide, forming a blue solution.

Which two statements confirm the acidic nature of the solution?

- A 1 and 2
- **B** 1 and 3
- **C** 2 and 4
- **D 3** and **4**
- **15** A solution of salt **X** gives an insoluble hydroxide **Y** on reacting with aqueous NaOH.

Hydroxide **Y** dissolves in excess aqueous NaOH to give solution **Z**. On adding aqueous HCl to **Z**, the hydroxide **Y** reappears but dissolves in excess aqueous HCl.

What type of hydroxide is hydroxide Y?

- A acidic
- B amphoteric
- **C** basic
- D neutral
- **16** Solution **X** contains two anions. The schematic diagram shows some reactions of solution **X**.



What are the anions found in solution X?

- A chloride and nitrate
- B chloride and sulfate
- **C** iodide and nitrate
- **D** iodide and sulfate

**17** In which one of the following reactions does the oxidation state of sulfur show the greatest increase?

A  $S + O_2 \rightarrow SO_2$ B Fe + S  $\rightarrow$  FeS C  $SO_3 + H_2O \rightarrow H_2SO_4$ D  $SO_2 + Cl_2 + 2H_2O \rightarrow 4H^+ + SO_4^{2-} + 2Cl^-$ 

- 18 In which reaction is the underlined substance acting as a reducing agent?
  - A <u>chlorine</u> + iron(II) chloride  $\rightarrow$  iron(III) chloride
  - **B** hydrogen +  $\underline{copper(II) \text{ oxide}} \rightarrow copper + water$
  - **C** <u>hydrochloric acid</u> + magnesium oxide  $\rightarrow$  magnesium chloride + water
  - **D** iron(III) oxide + <u>carbon monoxide</u>  $\rightarrow$  iron + carbon dioxide
- **19** An underground water tank made of iron is joined to a copper pipe.

Which of the following will occur?

- **A** The corrosion of copper is faster.
- B Electrons will flow from the iron to copper.
- **C** Copper atoms will be oxidised to form copper(II) ions.
- **D** A chemical cell will be formed with the copper pipe as the negative terminal.
- 20 In an experiment, metals **Q**, **R** and **S** were placed into four separate solutions containing aqueous metal ions to find the order of reactivity.

	Aqueous metal ion			
Metal	P <sup>2+</sup>	Q <sup>2+</sup>	R <sup>2+</sup>	S <sup>2+</sup>
Q	$\checkmark$	Х	$\checkmark$	$\checkmark$
R	Х	Х	Х	Х
S	Х	Х	$\checkmark$	Х

What is the order of reactivity of the metals?

	Most reactive			Least reactive
Α	Q	Р	R	S
В	Q	Р	S	R
С	Q	S	Р	R
D	R	S	Р	Q

- 21 Which of the following properties are characteristics of the transition metals but **not** of the alkali metals?
  - I are malleable and ductile
  - **II** are good conductors of electricity
  - III form coloured ions
  - **IV** show variable oxidation states
  - A I only
  - B I and III
  - C II and IV
  - D III and IV
- **22** Approximately 40% of all iron and steel is produced by recycling. The following statements are possible reasons for recycling iron.
  - 1. Recycling reduces the amount of waste taken to landfill sites.
  - 2. Recycling reduces the amount of pollution at the site of the ore extraction.
  - 3. Scrap steel contains a higher percentage of iron than iron ore.
  - 4. Recycling reduces the need to collect the scrap iron and steel.

Which of the following statements are correct?

- A 1 and 2 only
- **B** 1, 2 and 3 only
- **C** 1, 2 and 4 only
- **D** 1, 2, 3 and 4
- 23 Selenium, Se, is in the same group of the Periodic Table as sulfur.

What is the formula of potassium selenide?

- A K<sub>2</sub>Se
- **B** KSeO<sub>4</sub>
- C K<sub>2</sub>SeO<sub>4</sub>
- D KSeO<sub>3</sub>
- 24 Four electrolytes were electrolysed using carbon electrodes.

Which set of data is correct?

		Prod	uct at
	Electrolyte	Anode	Cathode
Α	CuSO₄ (aq)	Oxygen	Copper
В	NaCl (aq)	Chlorine	Sodium
С	NaH (I)	Sodium	Hydrogen
D	PbBr <sub>2</sub> (I)	Lead	Bromine

25 When magnesium chloride was electrolysed, magnesium was produced at the negative electrode.

In which form was the magnesium chloride in during the electrolysis?

- Α Concentrated aqueous solution
- В Dilute aqueous solution
- С Molten
- D Solid
- 26 The circuit shown is set up and an electric current is passed through the four cells in series.

In which cells are the intensity of the blue colouration of the solution unchanged?



- Α
- X and Y В
- X and Z С
- D Y and Z

27 Which of the following reaction is endothermic?

- Α Combustion of petroleum gases
- В Decomposition of copper(II) carbonate
- С Displacement reaction of silver ions by copper
- D Neutralisation of dilute nitric acid by aqueous ammonia

**28** The ozone layer in the atmosphere contains ozone, O<sub>3</sub>. The ozone absorbs ultraviolet light and breaks down to form oxygen.

$$2O_3 \rightarrow 3O_2$$

Which statement explains why the reaction is an endothermic reaction?

- A The number of bonds formed is greater than that broken.
- **B** More energy is absorbed to break bonds than released to form bonds.
- **C** Molecules release energy when they react.
- **D** The bonds formed are stronger than the bonds broken.
- **29** A student carried out two experiments to study various factors on the speed of reaction between ethanoic acid and magnesium.

 $2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2$ 

In the first experiment, 100 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> of dilute ethanoic acid was reacted with an excess of magnesium ribbon. A graph labelled **X** was plotted.

The experiment was repeated under the same conditions using a different set of reagents. A graph labelled  $\mathbf{Y}$  was plotted.



Which of the following set of reagents had been used to obtain graph **Y**?

- A 50 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> of dilute ethanoic acid + excess magnesium
- **B** 50 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> of dilute hydrochloric acid + excess magnesium
- C 50 cm<sup>3</sup> of 2 mol/dm<sup>3</sup> of dilute ethanoic acid + excess magnesium
- **D** 100 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> of dilute hydrochloric acid + excess magnesium
- **30** In which reaction is pressure least likely to affect the rate of reaction?
  - A NaOH (aq) + HCl (aq)  $\rightarrow$  NaCl (aq) + H<sub>2</sub>O (l)
  - $\mathbf{B} \qquad \mathsf{N}_2\left(g\right) + 3\mathsf{H}_2\left(g\right) \to 2\mathsf{N}\mathsf{H}_3\left(g\right)$
  - **C**  $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
  - **D**  $C(s) + CO_2(g) \rightarrow 2CO(g)$

**31** What are the conditions of the Haber process?

	Temperature/°C	Pressure/atm	Catalyst
Α	450	200	Nickel
В	200	450	Nickel
С	450	200	Iron
D	200	450	Iron

**32** Air contains 21.0% oxygen by volume. When a sample of river water is boiled, the expelled air contains 30.0% oxygen by volume.

What is the best explanation for this observation?

- A Nitrogen reacts with water.
- **B** The noble gases are insoluble in water.
- **C** Oxygen is more soluble in water than nitrogen.
- **D** Carbon dioxide is more soluble in water than oxygen.
- **33** The diagram shows the fractional distillation of crude oil.



Which row explains why fraction R is collected above fraction S?

	Boiling point of R	Average molecular mass of R	Enthalpy change of combustion of R in kJ/mol
Α	Higher than <b>S</b>	Smaller than S	More than <b>S</b>
В	Higher than <b>S</b>	Greater than S	More than <b>S</b>
С	Lower than S	Smaller than S	Less than <b>S</b>
D	Lower than S	Greater than S	Less than <b>S</b>

- 34 Which of the following substances does **not** have any isomers?
  - A Butane
  - B Fluoroethane
  - **C** Propanol
  - **D** Ethanoic acid
- **35** A molecule of hydrocarbon, C<sub>16</sub>H<sub>36</sub>, undergoes cracking to produce two molecules of butane and a number of ethene molecules.

How many ethene molecules are produced?

- **A** 4
- **B** 6
- **C** 8
- **D** 10
- **36** In the perfume industry, one substance which is used to produce the fragrance of roses is 2-phenylethanol. The structure of the molecule is shown.



Which statement about this molecule is correct?

- A It can undergo condensation polymerisation to form a polymer.
- **B** It is a saturated molecule.
- **C** It can decolourise bromine water.
- **D** It can be reduced by acidified potassium dichromate (VI) solution.

**37** Which of the following graphs shows how the rate of reaction varies with temperature for the fermentation of glucose?



**38** The table gives some information about certain esters and the fragrance they produce.



An ester is made from methanol and butanoic acid.

What fragrance would the ester have?

- A Apple
- B Pear
- **C** Pineapple
- D Rum

**39** Terylene (a polyester) is made by condensation polymerisation of the two monomers shown.



## What is the repeat unit of the polymer?









40 When an alkene reacts with bromine, the product formed is



Which of the following is the alkene?



End of Paper

DATA SHEET The Periodic Table of the Elements

	0	4 He <sup>Helium</sup>	20 Neon 10	40 Ar Argon	84 <b>Kr</b> Kryptor 36	131 Xe Xenon 54	Rn <sup>Radon</sup>		175 Lu Lutetium 71	Lawrencium 103	
-	VII		9 Fluorine	35.5 <b>C1</b> 17 Chlorine	80 <b>Br</b> Bromine 35	127 <b>I</b> Iodine	At Astatine 85		173 <b>Yb</b> Ytterbium 70	NO Nobelium	
	٨I		16 Oxygen 8	32 Sulfur 16	79 Selenium 34	128 Te Telluriun 52	PO Polonium 84		169 TM Thulium 69	Md Mendelevium 101	
	V		14 N T	31 Phosphorus 15	75 AS Arsenic 33	122 <b>Sb</b> Antimon Y	209 <b>Bi</b> Bismuth		167 Er Erbium 68	100 Fm	
Group	N	-		12 C Carbon 6	28 <b>Si</b> Silicon 14	73 <b>Ge</b> <sup>Germanium</sup> 32	119 <b>Sn</b> 11n	207 <b>Pb</b> Lead 82		165 HO Holmium 67	ES Einsteinium 99
	Ш					5 Boron	27 <b>A1</b> Aluminium 13	70 Ga Gallium 31	115 <b>In</b> 10dium	204 <b>T1</b> Thallium 81	
					65 Zn <sup>Zinc</sup>	112 Cd Cadmium 48	201 Hg <sup>Mercury</sup>		159 <b>Tb</b> Tethium 65	BK Berkelium 97	
					64 Cu <sup>Copper</sup>	108 <b>Ag</b> Silver	197 <b>Au</b> Gold 79		157 Gd Gadolinium 64	C Curium Curium	
					59 Nickel 28	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Am Americium 95	
					59 Co <sup>Cohalt</sup>	103 Rh Rhodiur 45	192 <b>II</b> fridium		150 Sm Samarium 62	Plutonium 94	
		1 Hydrogen			56 <b>Fe</b> Iron	101 Ru Rutheniur 44	190 <b>OS</b> 0smium 76		Promethium 61	Np Neptunium 93	
					55 Mn Manganese 25	TC Technetiu m	186 Re Rhenium 75		144 Neodymium 60	238 Uranium 92	
					52 Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		141 Praseodymium 59	Pa Protactinium 91	
					51 V Vanadium 23	93 Nb Niobium 41	181 Ta Tantalur 73		140 Ce Cerium 58	232 <b>Th</b> Thorium	
					48 <b>Ti</b> 22	91 Zr Zirconium 40	178 Hf 14afnium 72		1	mic mass nbol mic)	
5					45 Sc Scandium 21	89 4 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	139 La Lanthanum 57 *	227 AC Actiniu	d series series	= relative ato = atomic syr = proton (ato	
	Π		9 Beryllium 4	24 Mg Magnesium 12	40 Ca <sup>Calcium</sup>	88 Strontium 38	137 <b>Ba</b> Barium 56	226 Radium 88	anthanoi Actinoid	ة X م	
	-		7 Lithium 3	23 Na 11	39 K Potassium 19	85 Rb Rubidium 37	133 CS Caesium 55	<b>Fr</b> Franciurr 87	*58-71 L †90-103 ,	۰ Key	

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

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## METHODIST GIRLS' SCHOOL 2017 SEC 4 CHEMISTRY PRELIM EXAM PAPER 1

## Answer Scheme

1	В	21	D
<mark>2</mark>	C	22	В
3	A	23	A
4	В	24	А
5	С	25	С
6	В	26	D
7	D	27	В
8	С	28	В
9	D	<mark>29</mark>	B
10	D	30	A
11	D	31	С
12	С	32	С
13	A	33	С
14	D	34	В
15	В	35	A
16	D	36	С
17	А	37	D
18	D	38	А
19	В	39	А
20	В	40	D