O

ANDERSON SECONDARY SCHOOL
Preliminary Examination 2019
Secondary Four Express

CANDIDATE NAME

CLASS / INDEX NUMBER

CHEMISTRY **6092/02**

Paper 2

2 September 2019

1 hour 45 minutes

0800 – 0945h

No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A
Answer all questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer all three questions, the last question is in the form either/or.
Write your answers in the spaces provided on the Question Paper.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page **21**.

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

Section A	
Section B	
Total	

Section A

Answer all questions in this section in the spaces provided.
The total mark for this section is 50.

A1 The diagram below shows part of the Periodic Table with some elements.

							H										
													C				
Na												Al				Cl	Ar
	Ca						Fe			Cu	Zn					Br	
									Pd								
									Pt							At	

Choose from the elements shown in the diagram above and use the symbol of the elements to answer the questions.

Each elements may be used once, more than once or not at all.

(a) Which element is used to fill up light bulbs?

..... [1]

(b) Which elements have an atomic mass of 40?

..... [1]

(c) Which elements exist as a black solid?

..... [1]

(d) Which element forms a carbonate that is thermally stable?

..... [1]

(e) Which element is used as an aqueous solution to differentiate between saturated and unsaturated hydrocarbons?

..... [1]

(f) Which elements can be used as electrodes in the electrolysis of water?

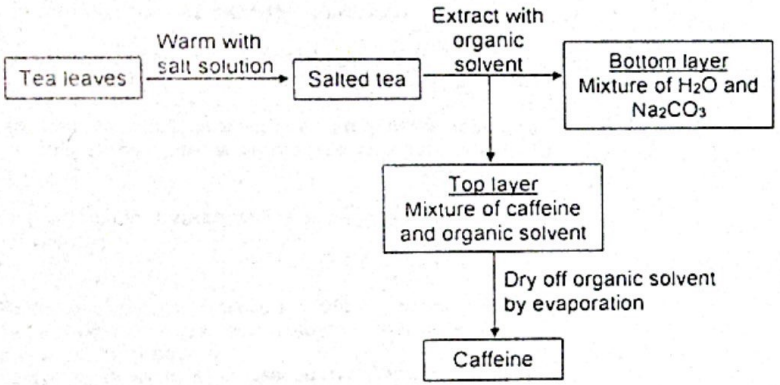
..... [1]

(a) Complete the table to name the most appropriate separation technique used to obtain the substance underlined in the mixture.

mixture	separation technique
<u>iodine</u> + sodium chloride	
water + <u>calcium sulfate</u>	
<u>ethanol</u> + glucose solution	

[3]

(b) The flow chart below shows the extraction of caffeine from tea leaves.



(i) From the steps, suggest two physical properties of caffeine.

.....

.....

[2]

.....

(ii) A chemical property displayed by caffeine in the extraction process is thermal stability. Based on the information provided, state an evidence which illustrates this property.

.....

[1]

.....

[Total: 6]

A3 In the Haber process, nitrogen and hydrogen are reacted together to form ammonia as shown in the equation below.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -92 \text{ kJ}$$

(a) State the conditions for the Haber process.

[2]

.....

(b) (i) The forward reaction for the production of 2 moles of ammonia has an energy change of –92 kJ. State the energy change for the backward reaction where 2 moles of ammonia decomposes.

[1]

.....

(ii) Hence, calculate the number of moles of ammonia that is decomposed when 230 kJ of energy is absorbed.

[1]

(c) Use ideas about bond breaking and bond making to explain why the forward reaction is exothermic.

.....

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.....

.....

.....

.....

[3]

Bond energy is the measure of the amount of energy needed to break apart one mole of covalently bonded gases. The table below shows some bond energies between nitrogen atoms.

bond	bond energy in kJ/mol
N–N	160
N=N	418
N≡N	941

(d) (i) Based on information given in the table, describe and explain the trend of bond energy between nitrogen atoms.

.....

.....

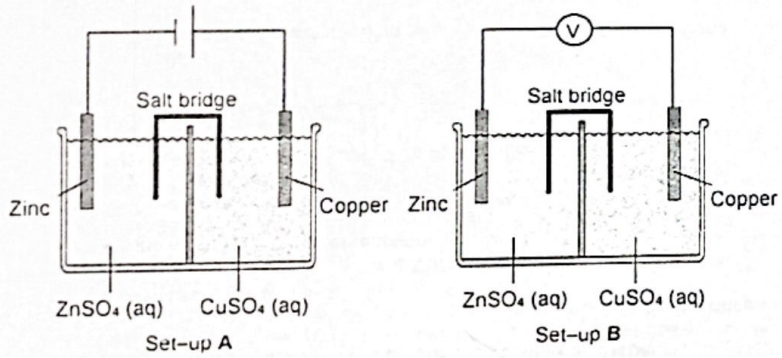
..... [2]

(ii) State the amount of energy absorbed to break 1 mole of nitrogen gas during the Haber process.

..... [1]

[Total: 10]

A4 The diagram shows two set–ups that a student used to investigate the difference in the reaction between electrolytic cell and simple cell.



(a) Draw arrows to show the flow of electrons on both set-ups clearly. [2]

(b) It was observed that the zinc electrode in set–up A increased in size, whereas the zinc electrode in set–up B decreased in size.

(i) Write an ionic half–equation, with state symbols, for the reaction at the zinc electrode in set–up A.

..... [1]

(ii) Describe two other differences in the observations between the two set–ups.

.....

.....

..... [2]

(c) The student would like to prepare more zinc sulfate and copper(II) sulfate for the experiments.

Complete the table below by filling in the missing information to provide the student with the preparation details. Include state symbols with any formulae.

salt	formulae of starting reagents used	procedures of method used
$ZnSO_4$ (s)	(i) ..... (ii) H_2SO_4 (aq)	1. Adding of excess solid to acid 2. .....
$CuSO_4$ (s)	(i) ..... (ii) H_2SO_4 (aq)	3. ..... 4. .....

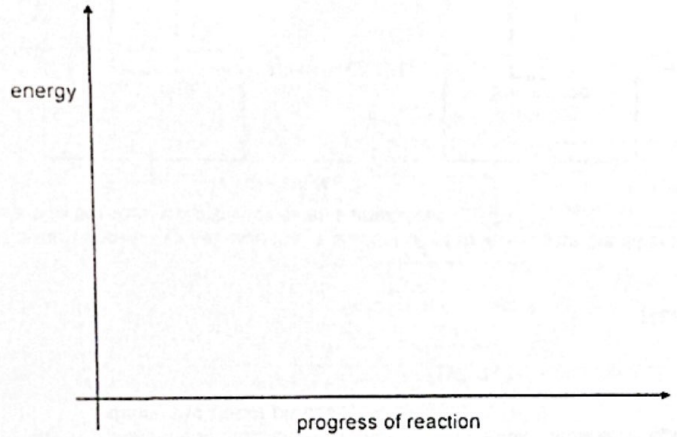
[2]

[Total: 7]

A5 A study has been done on the cracking of poly(propene), $(C_3H_6)_n$, as a possible alternative to solving plastic waste. It is an endothermic reaction which requires nano materials as catalyst. The products are mainly $C_7 - C_{10}$ hydrocarbons.

(a) Draw an energy profile diagram to show the effect of the catalyst on the cracking of poly(propene). Your diagram should show and label:

- the reactants and products,
- the activation energy of the uncatalysed and catalysed reactions,
- the enthalpy change of reaction.



[3]

(b) (i) Draw the structure of the repeating unit of poly(propene) and give the empirical formula of poly(propene).

[2]

(ii) Using its empirical formula, construct a balanced chemical equation for the complete combustion of poly(propene).

[1]

(iii) Hence, calculate the volume of carbon dioxide produced when 1 kg of poly(propene) is completely burned in air.

[2]

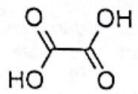
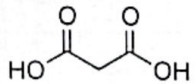
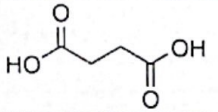
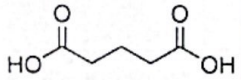
(c) Poly(propene) is a main form of plastic waste because of its wide variety of applications such as to make water pipes.

Suggest an advantage and a disadvantage of using poly(propene) instead of iron to make water pipes.

[2]

[Total: 10]

A6 The table shows some information of the homologous series of a class of organic compounds called dicarboxylic acids.

name	condensed formula	*skeletal formula	m.p / °C
ethanedoic acid	HOOCCOOH		189
			136
butanedoic acid	$HOOC(CH_2)_2COOH$		185
pentanedoic acid	$HOOC(CH_2)_3COOH$		98

**In skeletal formulae, the carbon atoms are implied to be located at the corners and ends of line segment rather than being indicated with atomic symbol C. Hydrogen atoms attached are also not indicated but understood to be present accordingly.*

(a) (i) Fill in the table to show the name and condensed formula of the dicarboxylic acid missing in the homologous series. [1]

(ii) What is the general formula of the members in this homologous series?

..... [1]

(b) Describe the trend of the melting point of dicarboxylic acids.

.....

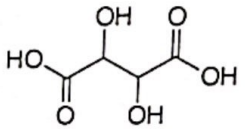
..... [1]

(c) A student claim that dicarboxylic acids are able to undergo condensation polymerization on its own. Explain whether you agree with the claim.

.....

..... [1]

(d) Tartaric acid is a substituted dicarboxylic acid which is found in unripe grapes, making it taste sour. It is a weak, dibasic acid and undergoes neutralization with potassium hydroxide. The potassium salt of tartaric acid, known as 'cream of tartar', is used in cooking. The skeletal formula of tartaric acid is shown below.



Tartaric acid

(i) Explain the term weak, dibasic acid.

.....

.....

..... [2]

(ii) Draw the skeletal formula of the salt formed when tartaric acid undergoes complete neutralisation with potassium hydroxide.

[1]

(iii) Suggest two differences in the structural formula between tartaric acid and butanoic acid, C_3H_7COOH.

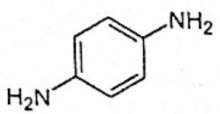
.....

.....

.....

..... [2]

(iv) Tartaric acid undergoes condensation polymerization reaction with 1, 4-phenylene-diamine to form a polyamide. The skeletal formula of 1, 4-phenylene-diamine is shown below.



1, 4-phenylene-diamine

Draw the structure of the polyamide, showing one repeat unit.

[2]

[Total: 11]

Section B

Answer all **three** questions in this section.

The last question is in the form of an either/or and only **one** of the alternatives should be attempted.

B7 A student investigated the rate of reaction in a series of experiments for the following reaction:

$$2ClO_2\,(aq) + 2OH^-\,(aq) \rightarrow ClO_3^-\,(aq) + ClO_2^-\,(aq) + H_2O\,(l)$$

The initial rate of this reaction was determined using different concentrations of the reactants as shown in the following experiments.

Table 1 shows his results.

Experiment	Concentration of ClO_2 (mol/dm^3)	Concentration of OH^- (mol/dm^3)	Initial rate of reaction (mol/dm^3 s)
1	0.02	0.03	0.00276
2	0.02	0.06	0.00552
3	0.04	0.03	0.01104
4	0.04	0.03	0.02014
5	0.04	0.06	0.02208

Table 1

From the data in Table 1, changes in the concentration of each reactant affect the rate of reaction differently. Knowing how the rate is affected by the concentration of each reactant will allow us to predict the rate of reaction.

We can classify the reactions into the following two types as shown in Table 2.

Type of reaction	Characteristic	Example
First order reaction with respect to reactant A	The rate of reaction is proportional to the concentration of A.	If you double the concentration of A, the rate doubles. If you increase the concentration of A by a factor of 4, the rate goes up 4 times.
Second order reaction with respect to reactant A	The rate of reaction is proportional to the square of the concentration of A.	If you double the concentration of A, the rate would go up 4 times (2^2). If you tripled the concentration of A, the rate would increase 9 times (3^2).

Table 2

(a) The student carried out four experiments using solutions at room temperature and one experiment using solutions at a higher temperature.

Which experiment was carried out at a higher temperature?

Explain your reasoning using information from Table 1.

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.....

.....

..... [2]

(b) (i) Using information from Table 1, describe how the rate of reaction changes as the concentration of ClO_2 changes.

.....

.....

..... [2]

(ii) Hence, determine the order of reaction with respect to ClO_2.

..... [1]

(c) Determine the rate of reaction when concentration of both ClO_2 and OH^- are 0.01 mol/dm^3. [1]

.....

(d) Explain, in terms of collision between reacting particles, the effect of concentration on the speed of reaction.

.....

.....

.....

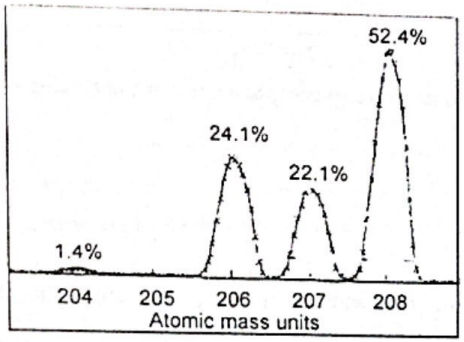
..... [3]

(e) Oxides of chlorine, other than ClO_2, can also exist as Cl_2O. Draw a 'dot–and–cross' diagram to show the bonding in Cl_2O.
Show outer electrons only.

[2]

[Total: 11]

B8 The relative abundances of isotopes can be determined experimentally using a technique called mass spectrometry. The mass spectrum of four lead isotopes and their respective natural abundance is shown below.



(a) Based on the information, calculate the relative atomic mass of lead. Show your workings clearly and give your answer to the nearest whole number.

[2]

(b) A lead compound was found to have the following composition by mass.

Pb, 86.8%; O, 13.2%

(i) Use these data to work out the empirical formula of the lead compound.

[2]

(ii) Hence, name the compound when its M_r is 239.

.....

[1]

(c) Back in 1921, lead was added to gasoline to reduced "engine knock" in cars but was subsequently banned and replaced by ethanol to provide the same effect. Ethanol has also been commonly used as an alternative fuel source for cars as "gasohol", consisting of 90% gasoline and 10% ethanol, since 1970.

The table gives the values for the energy change of combustion for ethanol and octane, a representative component of gasoline.

fuel	chemical formula	ΔH (kJ/mol)
octane	C_8H_{18}	−5509
ethanol	C_2H_5OH	−1407

(i) Calculate the energy output for 1g of each of the fuels.

[2]

(ii) Discuss a disadvantage of using gasohol instead of gasoline and suggest a reason why it is still being used currently.

.....

.....

..... [2]

[Total: 9]

Either

B9 The table below shows some properties exhibited by Period 4 metals.

element	density / g/cm^3	melting point / °C	common oxidation states
potassium	0.9	64	+1
calcium	1.5	842	+2
scandium	3.0	1541	+3
titanium	4.5	1660	+2, +3, +4
vanadium	6.1	1917	+2, +3, +4, +5
chromium	7.9	1857	+2, +3, +4, +5, +6
manganese	7.2	1244	+2, +3, +4, +5, +6, +7
iron	7.9	1537	+2, +3, +4, +6
cobalt	8.7	1494	+2, +3, +4
nickel	8.9	1455	+2, +3, +4
copper	8.9	1084	+1, +2

(a) Using information from the table, compare the properties between the main group metals and transition metals in Period 4.

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.....

.....

..... [3]

(b) Describe and explain two differences that can be observed when the metals potassium and iron are added to dilute hydrochloric acid respectively.

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.....

.....

.....

.....

..... [4]

(c) The table below shows the colour of chromium ions in different conditions.

oxidation state	colour in acidic solution	colour in alkali solution
+2	blue	
+3	green	green
+6	orange	yellow

The production of potassium dichromate from chromite ore, $FeCr_2O_4$, is a three–step process.

Step 1: The ore is fused with alkaline aqueous sodium carbonate in air.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

Step 2: Sodium chromate is filtered and acidified with sulfuric acid to form sodium dichromate.

$$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na + H_2O$$

Step 3: Sodium dichromate is added with KC*l* to form potassium dichromate.

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

(i) Complete the table by stating the colour of the solution at the end of step 1 and step 2.

At the end of	colour of solution
step 1	
step 2	

[2]

(ii) A student recommended that step 2 of the reactions needs to be carried out in a controlled environment. Comment on the student's recommendation.

.....

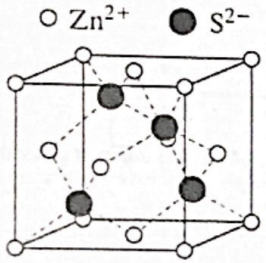
..... [1]

[Total:10]

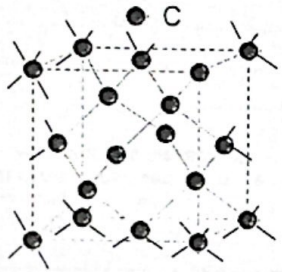
OR

B9 Sphalerite, also called zinc blende is the chief ore mineral of zinc. It exists in crystalline form and is the most important mineral of zinc.

The boxes show the structures and melting points of zinc blende (ZnS) and diamond.



Zinc blende



Diamond

(a) Draw a 'dot-and-cross' diagram to show the bonding in zinc blende. Show outer electrons only.

[2]

(b) Compare the bonding and structures of the two compounds.

.....

.....

.....

..... [3]

(c) The extraction of zinc from zinc blende is a three–step process.

Zinc blende first undergoes roasting where zinc sulfide is converted into zinc oxide and sulfur dioxide.

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

Zinc oxide is then added together with coke in the blast furnace to form zinc and carbon monoxide.

$$ZnO + C \rightarrow Zn + CO$$

The molten zinc obtained contains impurities such as lead and iron and requires fractional distillation where pure zinc will be collected first.

(i) The extraction of zinc produces waste gases which requires treatment before releasing into the environment. Explain, why it is necessary to treat the gases and name the treatment method for the gases.

.....

.....

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.....

..... [3]

(ii) A production worker may have accidentally added zinc blende directly into the blast furnace without roasting. Describe a chemical test to determine if it is true.

.....

.....

..... [2]

[Total: 10]

End of paper

O

ANDERSON SECONDARY SCHOOL
Preliminary Examination 2019
Secondary Four Express

CANDIDATE NAME

CLASS / INDEX NUMBER

CHEMISTRY

6092/01

Paper 1 Multiple Choice

3 September 2019

1 hour

1000 – 1100h

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.
Write your name, class and index number on the Answer Sheet in the spaces provided.

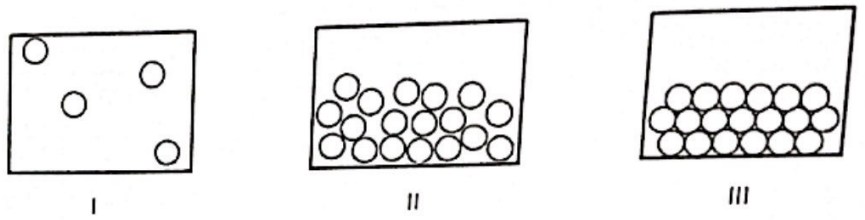
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers A, B, C, D.
Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for the wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 21.

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

1 Diagrams I, II and III show the particles of three substances at room temperature and pressure.

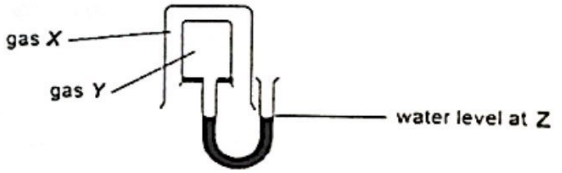


I II III

Which of these substances are correctly represented by the corresponding diagram?

	I	II	III
A	ethanol	hydrogen chloride	dry ice
B	helium	mercury	zinc
C	methane	sodium chloride	copper
D	water	argon	mercury

2 The set–up below shows how the relative rate of diffusion of gas X and Y can be determined.



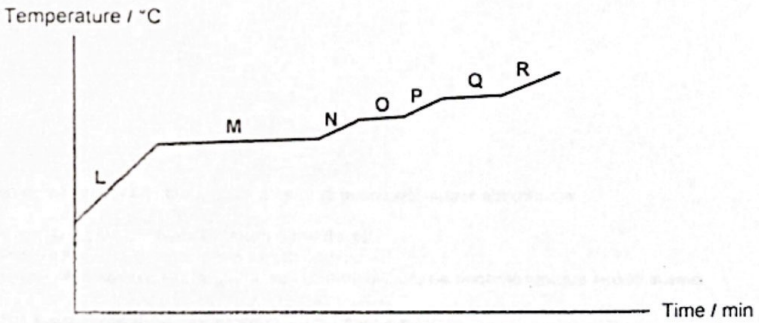
Which pair of substances could X and Y be if the water level at Z decreases?

	X	Y
A	ethane	argon
B	carbon monoxide	neon
C	methane	oxygen
D	nitrogen	carbon dioxide

3 The three main components of liquid air are nitrogen, oxygen and argon. Their respective boiling points are:

Nitrogen: −196°C
Oxygen: −183°C
Argon: −186°C

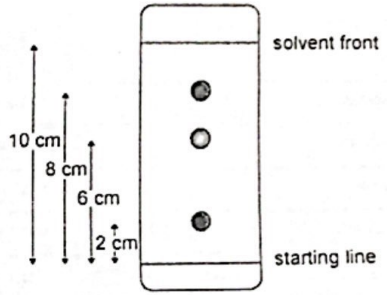
Liquid air can be separated into its three main components by fractional distillation. The graph shows the temperature of a liquid air mixture as it is heated.



In section N of the graph, the mixture remaining consists of

A liquid nitrogen and argon only.
B liquid nitrogen only.
C liquid oxygen and argon only.
D liquid oxygen only.

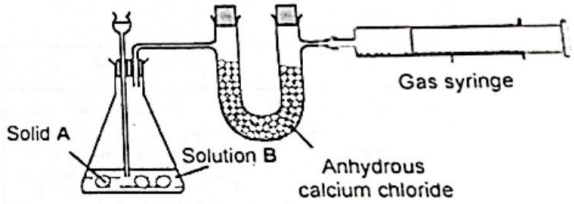
4 The diagram shows the chromatogram obtained by analysis of a dye mixture. Three measurements are shown in the diagram below.



What is the R_f value of the most soluble dye?

A 0.20
B 0.80
C 1.25
D 5.00

5 The diagram shows a simple laboratory set-up used to prepare and collect a dry gas.



Which pair of reagents would be most suitable to prepare the gas produced using this set-up?

	solid A	solution B
A	ammonium chloride	sodium hydroxide
B	calcium carbonate	aqueous ammonia
C	potassium hydroxide	sulfuric acid
D	zinc	hydrochloric acid

6 The solubilities of three solids in water and tetrachloromethane are given in the table below.

solid	solubility in water	solubility in tetrachloromethane
sand	not soluble	not soluble
sodium chloride	good	not soluble
sulfur	not soluble	good

Which of the experimental procedures would be suitable for obtaining pure sand from a mixture of sand, sodium chloride and sulfur?

A Add tetrachloromethane and stir, then filter to collect residue.

B Add tetrachloromethane and stir, then filter. Add the residue to water and stir, then filter to collect residue.

C Add water and stir, then filter. Evaporate the filtrate to dryness.

D Add water and stir, then filter. Add tetrachloromethane to filtrate and stir, then evaporate to dryness.

7 Brass is an alloy of copper and zinc. Copper has a melting point of 1085°C and zinc 419.5°C. Which of the following is a possible melting point of brass?

A Above 419.5°C

B Above 1085°C

C Below 1085°C

D Between 419.5°C and 1085°C

8 An ion of formula X^{2-} contains 18 electrons. If the relative atomic mass of X is 32, what is present in the nucleus of the ion?

A 16 protons and 16 neutrons

B 16 protons and 18 electrons

C 18 protons and 14 neutrons

D 18 protons and 18 electrons

9 Which statement correctly describes the properties of the compound copper(II) sulfide, CuS and mixture of copper and sulfur?

	copper(II) sulfide	mixture of copper and sulfur
1	copper and sulfur react when heated to form copper(II) sulfide	copper and sulfur mix together with no energy change
2	the ratio of copper to sulfur is always 1 : 1	the ratio of copper to sulfur can vary
3	copper(II) sulfide has the same properties as copper and sulfur	the mixtures do not have the same properties as copper and sulfur

A 1 only

B 1 and 2

C 2 and 3

D All the above

10 Which compound contains both ionic and covalent bonds?

A ammonia

B beryllium chloride

C ethyl ethanoate

D potassium nitrate

11 An investigation of the properties of the chlorides of Period 3 elements shows that the boiling points of sodium chloride and silicon tetrachloride are 1465°C and 57°C respectively. This difference in boiling points is a result of

A covalent bonds being weaker than ionic bonds.

B metallic character decreasing across the period.

C silicon forming weaker bonds with chlorine as compared to sodium.

D silicon tetrachloride having weak intermolecular forces of attraction.

12 Two comments about hydrogen chloride are made below.

Comment 1: Hydrogen chloride has strong covalent bonds in its simple molecular structure.
Comment 2: Hydrogen chloride is soluble in water.

Which statement is correct?

A Both comments are correct and comment 1 explains comment 2.
B Both comments are correct but comment 1 does not explain comment 2.
C Both comments are incorrect.
D Comment 2 is correct but comment 1 is incorrect.

13 The reaction of nitrogen dioxide with water is as shown.

$$w\ NO_2 + x\ H_2O \rightarrow y\ HNO_3 + z\ HNO_2$$

Which of the following values will give a balanced equation for the reaction above?

	w	x	y	z
A	1	1	1	1
B	2	1	1	1
C	2	2	1	1
D	4	2	2	2

14 Antimony is in the same group as nitrogen in the Periodic Table. What is the chemical formula of lithium antimonide?

A Li_3An
B $LiAnO_3$
C Li_3Sb
D $LiSbO_3$

15 Which statements about molecular mass is **incorrect**?

A It is the mass obtained on an electronic balance by 1g of the molecules.
B It is the ratio of the average mass of a molecule to the mass of a ^{12}C atom.
C It is the ratio of the mass of 1 mole of molecules to the mass of 1 mole of ^{12}C atom.
D It is the sum of the relative atomic masses of all the atoms within the molecules.

16 Which substance contains the greatest number of atoms in 1g?

A CO_2
B NO_2
C O_2
D SO_2

17 100 cm^3 of ammonia burns in 50 cm^3 of oxygen according to the following equation:

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$$

What volume of gas will be collected at the end of the reaction when cooled to room temperature?

A 33.3 cm^3 B 50.0 cm^3
C 66.7 cm^3 D 166.7 cm^3

18 The fertilisers ammonium nitrate (NH_4NO_3, M_r = 80) is manufactured from ammonia (NH_3, M_r = 17) by a two-stage process.

Stage 1: $NH_3 + 2O_2 \rightarrow HNO_3 + H_2O$
Stage 2: $HNO_3 + NH_3 \rightarrow NH_4NO_3$

What is the maximum mass of fertilizer that can be made if only 17 tonnes of ammonia is available?

A 34 tonnes B 40 tonnes
C 80 tonnes D 97 tonnes

19 Magnesium oxide is produced by heating magnesium carbonate.

$$MgCO_3 \rightarrow MgO + CO_2$$

When 84 g of magnesium carbonate is heated, 34 g of magnesium oxide is produced.
What is the percentage yield of magnesium oxide?
[M_r: $MgCO_3$, 84; MgO, 40]

A $\frac{34}{40} \times 100$

B $\frac{34}{84} \times 100$

C $\frac{40}{34} \times 100$

D $84 \times \frac{34}{40} \times 100$

20 35.0 cm^3 of 0.500 mol/dm^3 hydrochloric acid were added to 1.41 g of a sample of sodium carbonate containing some sodium chloride as impurity. The excess acid was neutralised by 15.0 cm^3 of 0.400 mol/dm^3 of sodium hydroxide solution.

What is the percentage purity of the sodium carbonate in the sample?
[M_r: HCl, 36.5; Na_2CO_3, 106; NaOH, 40]

A 43.2% B 45.1%

C 86.5% D 90.2%

21 Which method(s) is/are suitable to test the strengths of acids and alkalis?

1 titration
2 measuring their electrical conductivity
3 using a pH meter

A 1 only
B 1 and 3
C 2 and 3
D All of the above

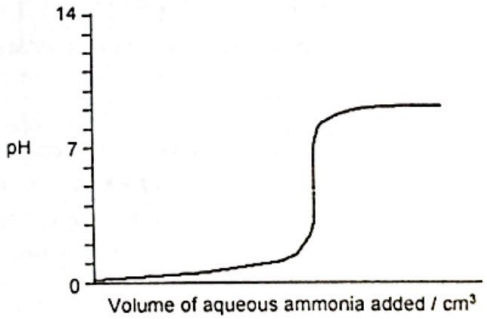
22 Arsine (AsH_3) is a gas that behaves like ammonia. Which of the following particles are found in the solution when Arsine dissolves in water?

A As^+ and OH^-
B AsH_3, As^+ and OH^-
C AsH_4^+ and OH^-
D AsH_3, AsH_4^+ and OH^-

23 Different indicators change colour over different pH ranges and it is important to choose the correct indicator to obtain an accurate result in a titration.

indicator	pH range for the colour change	colour	
		lower pH	higher pH
indigo carmine	11.6 – 14.0	blue	yellow
methyl red	4.2 – 6.3	red	yellow
methyl violet	0.3 – 3.0	yellow	violet
phenolphthalein	8.2 – 10.0	colourless	pink

The graph below shows the change of pH when aqueous ammonia is added to a fixed volume of dilute hydrochloric acid in a titration.



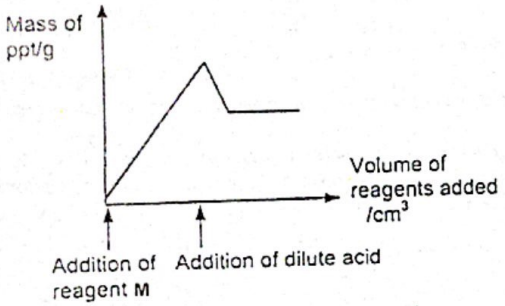
Which indicator would be the best choice to use in this titration?

A indigo carmine B methyl red
C methyl violet D phenolphthalein

24 Which substance has metallic bonding?

substance	electrical conductivity		property of product formed from the reaction between substance and oxygen
	in solid state	in molten state	
A	X	X	reacts with alkali
B	X	✓	no reaction with acid or alkali
C	✓	✓	reacts with alkali
D	✓	✓	reacts with both acid and alkali

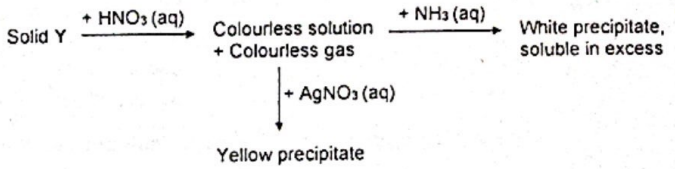
25 In a quantitative analysis, reagent **M** is gradually added to a salt solution **N** (that contains either 1 or 2 different anions), followed by the addition of a dilute acid. The graph below shows how the mass of precipitate formed changes with the reagents added.



Which of the following combinations would produce the graph above?

	anions in N	reagents (M and acid) added
A	CO_3^{2-}	$AgNO_3$ and HNO_3
B	CO_3^{2-}, Cl^-	$BaCl_2$ and HNO_3
C	CO_3^{2-}, SO_4^{2-}	$AgNO_3$ and HCl
D	CO_3^{2-}, SO_4^{2-}	$BaCl_2$ and HCl

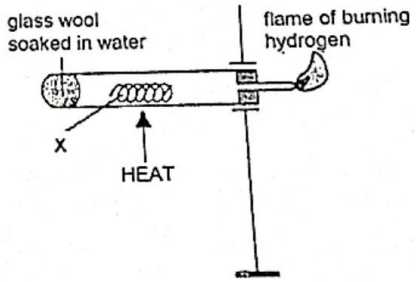
26 Solid Y contains a mixture of two salts. The scheme below shows some reactions of solid Y.



Which of the following could be the two salts present in solid Y?

A aluminium carbonate and ammonium chloride
B calcium chloride and zinc carbonate
C lead(II) carbonate and sodium iodide
D zinc iodide and calcium carbonate

27 The set-up below shows the reaction of substance **X**.



What is the possible identity of **X**?

A X is a metal above hydrogen in the reactivity series.
B X is a metal below hydrogen in the reactivity series.
C X is an oxide of a metal that is above hydrogen in the reactivity series.
D X is an oxide of a metal that is below hydrogen in the reactivity series.

28 The following observations were made when nickel and iron were placed separately into solutions of metals **S**, **T** and **U**.

	salt solution of **S**	salt solution of **T**	salt solution of **U**
nickel	displaced	not displaced	not displaced
iron	displaced	displaced	not displaced

What is the correct order in increasing reactivity of the five metals?

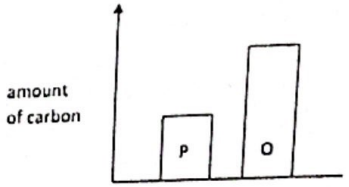
A S < Ni < Fe < T < U

B S < Ni < T < Fe < U

C U < Fe < T < Ni < S

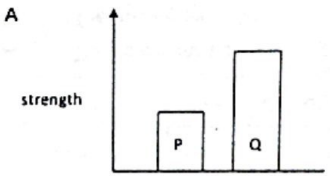
D U < T < Fe < Ni < S

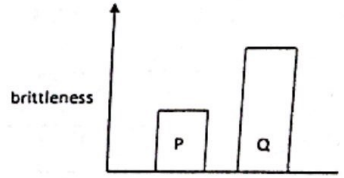
29 The diagram compares the amount of carbon in two steels, **P** and **Q**?



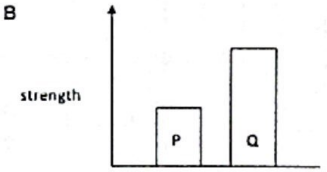
Which two diagrams correctly compare the strength and brittleness of **P** and **Q**?

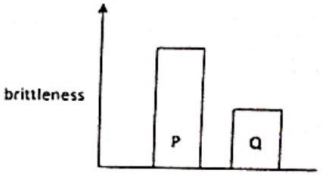
A



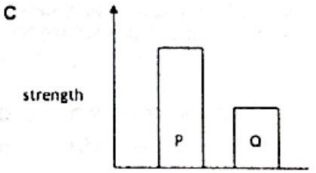


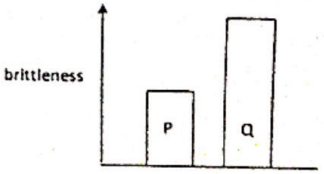
B



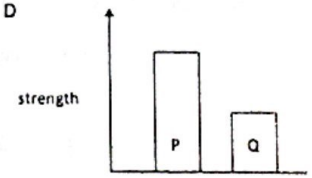


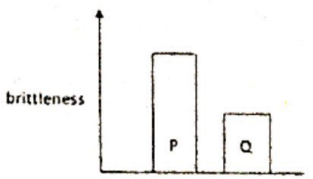
C



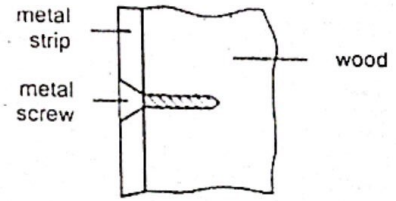


D





30 An old railway carriage is being restored by having metal strips secured to the outside of the wooden carriage by means of screws.

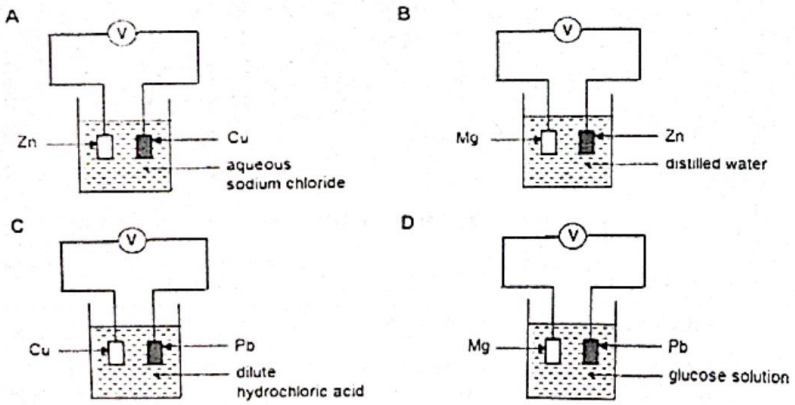


After a few weeks of being exposed to wind and rain, the screws are heavily corroded but the metal strips are not.

Which two metals would give this result?

	screw	strip
A	copper	steel
B	copper	zinc
C	steel	copper
D	steel	magnesium

31 Which set-up would produce the greatest reading on the voltmeter?



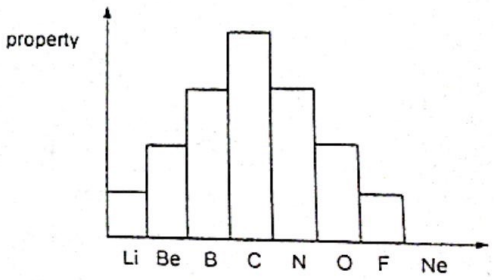
32 For which process is the enthalpy change always positive?

A combustion
B dissolving of acids in water
C evaporation
D respiration

33 Which of the following reactions takes place in a hydrogen fuel cell?

A Hydrogen ions are oxidised at the anode.
B Hydrogen ions are reduced at the cathode.
C Hydrogen loses electrons to form H^+ ions at the anode.
D Oxygen gains electrons to form O^{2-} at the cathode.

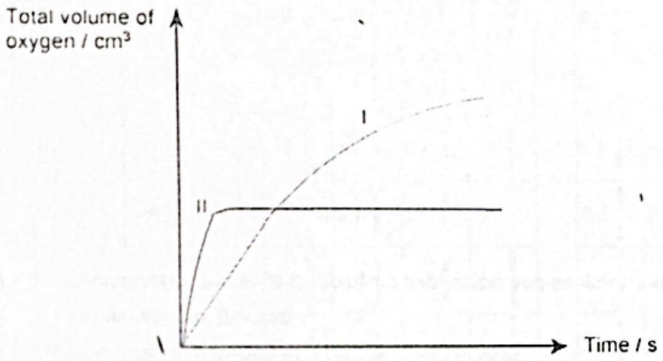
34 The bar chart shows the variation of a specific property of elements in Period 2 from lithium to neon. Which property of these elements is shown in the chart?



A The atomic radius.
B The melting point.
C The number of electrons used in bonding.
D The number of shells holding electrons.

35 Manganese(IV) oxide catalyses the decomposition of aqueous hydrogen peroxide into water and oxygen.

In order to follow the rates of this reaction for two different solutions of hydrogen peroxide, the total volumes of oxygen evolved were recorded at regular time intervals and the results were plotted. In each experiment, the same mass of catalysts were used and the temperature kept constant.



If curve I corresponds to 20.0 cm^3 of 4.0 mol/dm^3 of solution, curve II would correspond to

A 5.0 cm^3 of 8.0 mol/dm^3 solution.

B 10.0 cm^3 of 4.0 mol/dm^3 solution.

C 20.0 cm^3 of 2.0 mol/dm^3 solution.

D 20.0 cm^3 of 8.0 mol/dm^3 solution.

36 Which statement about the fractional distillation of crude oil is correct?

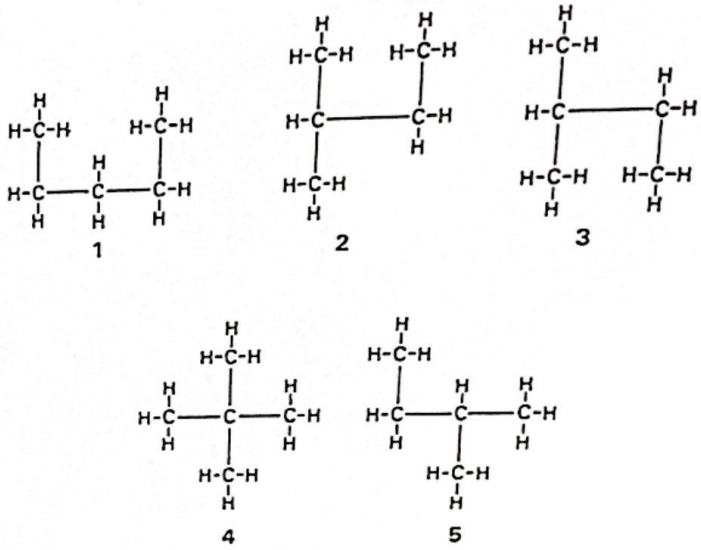
A At each level of the fractionating column, only one compound is collected.

B The higher up the fractionating column, the higher the temperature.

C The fraction at the top of the column are the least flammable.

D The fraction collected at the bottom of the column have the highest viscosity.

37 Five structural formulae are shown below.



How many of the structures represent isomers of one another?

A 2 B 3

C 4 D 5

38 A student investigated the reaction of different vegetable oils and margarines with hydrogen.

100 cm^3 of hydrogen was passed through 1g samples containing a catalyst. The volume of hydrogen gas remaining in each reaction was recorded in the table below.

sample	volume of hydrogen remaining (cm^3)
P	0
Q	87
R	100

Which sample(s) is/are margarine?

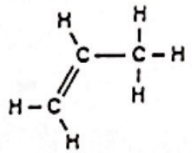
A P only
B P, Q and R
C P and Q
D R only

39 In which reaction is water **not** a product?

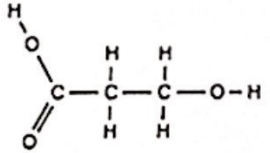
A combustion of fossil fuels
B esterification between ethanoic acid and ethanol
C fermentation of glucose
D neutralization between dilute hydrochloric acid and aqueous ammonia

40 Which of the following monomer(s) would undergo polymerisation on their own?

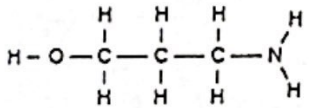
I



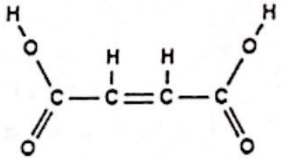
II



III



IV



A I, II and III
B I, II and IV
C II and III
D All of the above