Section A

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

For Examiner's Use

A1 Iron is extracted from iron ore in the Blast Furnace.
The equations A, B, C, D and E show some reactions that happen in the Blast Furnace.

A $C + O_2 \rightarrow CO_2$

B $CO_2 + C \rightarrow 2CO$

C $Fe_2O_3 + 3CO \rightarrow 3CO_2 + 2Fe$

D $CaCO_3 \rightarrow CaO + CO_2$

E $SiO_2 + CaO \rightarrow CaSiO_3$

Use the letters A, B, C, D and E to answer the following questions.

(a) Which equation shows combustion?

..... [1]

(b) Which equation shows thermal decomposition?

..... [1]

(c) Which equation shows a reaction between an acidic compound and a base?

..... [1]

(d) Which equation shows the formation of a toxic gas?

..... [1]

[Total: 4]

A2 Blast furnace can also be used to extract copper from its ores, which are chemically copper(I) sulfide. In the blast furnace, blasts of hot air are blown through the ore to convert copper(I) sulfide to solid copper(I) oxide and sulfur dioxide. The copper(I) oxide is then further converted by coke to molten copper, which is collected at the bottom of the furnace.

(a) Write a chemical equation, including state symbols, for the conversion of copper(I) sulfide to copper(I) oxide.

..... [2]

Sec 4 Pure chem Mock Paper Set 4 (Xmss)

For Examiner's Use

A2 (b) Describe a chemical test to identify the presence of sulfur dioxide in the waste gases produced during the extraction process. Include your observations.

Test .....

..... [1]

Observation .....

..... [1]

(c) Sulfur dioxide is a pollutant and poses a danger to both health and environment if it is allowed to escape into the surroundings.
State one harmful effect to humans and one harmful effect to the environment that arise from sulfur dioxide.

Harmful effect to humans .....

..... [1]

Harmful effect to the environment .....

..... [1]

(d) The emission of sulfur dioxide can be reduced by passing the waste gases through a chamber containing finely powdered calcium oxide. The equation for the reaction is

$$CaO + SO_2 \rightarrow CaSO_3$$

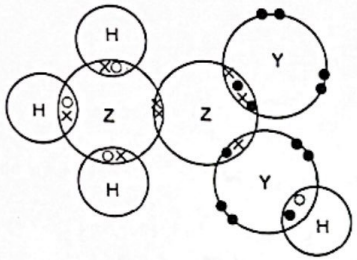
It was estimated that the daily sulfur dioxide emission from a copper extraction plant was 22 tonnes. Calculate the mass of calcium oxide needed daily to remove the mass of sulfur dioxide produced. (1 tonne = 1000 kg)

mass of CaO = ... kg [3]

[Total: 9]

For Examiner's Use

A3 The diagram below shows the arrangement of electrons in a compound of hydrogen, H, element Y and element Z.
Only outer shell electrons are shown.



(a) What type of bonding is present in this compound?

..... [1]

(b) Elements Y and Z have proton numbers between 2 and 11.
Name elements Y and Z.

element Y .....

element Z ..... [2]

(c) Using the correct symbols for elements Y and Z, give the empirical formula of this compound.

..... [1]

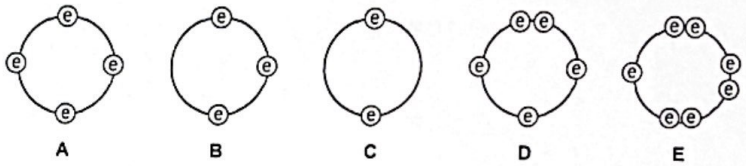
(d) Using your understanding of bonding and structure, which of these statements would you predict to be TRUE and which would you predict to be FALSE for this compound?
Put a tick (✓) in one box in each row.

This compound ...	TRUE	FALSE
has a low boiling point.		
has good electrical conductivity when molten.		
is very soluble in water.		
is a crystalline solid at room temperature.		

[2]

[Total: 6]

A4 These diagrams show the electron arrangement in the outer shells of five elements, A to E. All elements are from Period 2 of the Periodic Table.



Use the letters A to E to answer the following questions.
Each letter may be used once, more than once, or not at all.

(a) Which element is likely to be a metal?

..... [1]

(b) Which element has an proton number of 4?

..... [1]

(c) Which element exists as diatomic molecules with triple covalent bonds?

..... [1]

(d) Which two elements will form a compound with the formula of the type YZ_2?

..... [2]

[Total: 5]

For Examiner's Use

A5 (a) Table 5.1 shows data about the melting points and boiling points of three halogens – chlorine, bromine and iodine.
Complete Table 5.1 by filling in the name of each halogen.

name of halogen	melting point / °C	boiling point / °C
	− 7.2	58.8
	− 100.9	− 34.7
	113.8	184.5

[1]

Table 5.1

(b) Sea water contains potassium bromide.

(i) Bromine can be produced from sea water by displacement.
Name an element that can displace bromine.
Give a reason for your choice.

name .....

reason .....

..... [2]

(ii) Write an ionic equation for the displacement of bromine from sea water, using your answer from (b)(i).

..... [1]

(c) The Thermite reaction is used to weld railway rails together.
Aluminium powder reacts with iron(III) oxide to make small amounts of molten iron which runs into the gaps between the rails. Solid aluminium oxide is made at the same time
The equation for the reaction is as follows

$$2\,Al\,(s) + Fe_2O_3\,(s) \rightarrow 2\,Fe\,(l) + Al_2O_3\,(s)$$

(i) The reaction is an example of a metal displacement reaction and is highly exothermic.
The amount of heat energy given out is displacement reactions depends on the difference in reactivity of the two metals.
Suggest another metal that can replace aluminium to give a more exothermic reaction with iron(III) oxide.

..... [1]

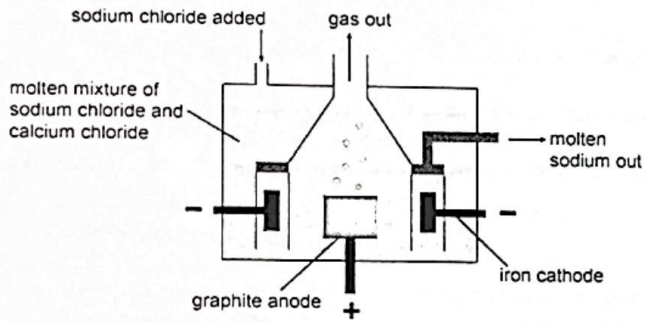
A5 (c) (ii) 100 kg of aluminium powder and 100 kg of iron(III) oxide are used to produce 50 kg of aluminium oxide during welding.
Calculate the percentage yield of aluminium oxide.

[5]

[Total: 10]

For Examiner's Use

A6 Sodium metal can be extracted from molten sodium chloride by electrolysis. The diagram below shows how the process works.



(a) (i) Write an ionic half equation, including state symbols, to show the reaction that happens at the anode.

..... [2]

(ii) Describe a simple test and its result that would identify the gas given off at the anode.

test .....

.....

result .....

.....

..... [2]

(b) Calcium chloride is added to the sodium chloride to lower the melting point of the mixture.

(i) Explain why lowering the melting point makes the process cheaper to run.

.....

..... [1]

For Examiner Use

A6 (b) (ii) The molten sodium contains metallic impurities,
Name the main metal impurity you would expect to find and explain how it forms.

.....

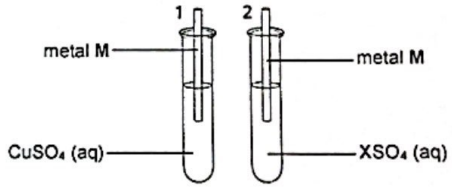
.....

.....

.....

..... [2]

(c) A student set up the apparatus as shown below:



In test tube **1**, he placed a rod of metal **M** into copper(II) sulfate solution.
In test tube **2**, he placed a rod of metal **M** into the sulfate solution of metal **X**.

After some time, he made the following observations:

	test tube **1**	test tube **2**
Observation	Pink deposit on metal **M**. Blue colour turns colourless.	Grey deposit on metal **M**. Green solution turns colourless.

(i) Based on the observations, state one conclusion you can make about the reactivity of metal **M** compared to copper and metal **X**.

.....

..... [1]

For Examiner's Use

A6 (c) (ii) Describe how you can perform a similar experiment to compare the reactivity between copper and metal **X**. Include observations and explain your answer.

.....

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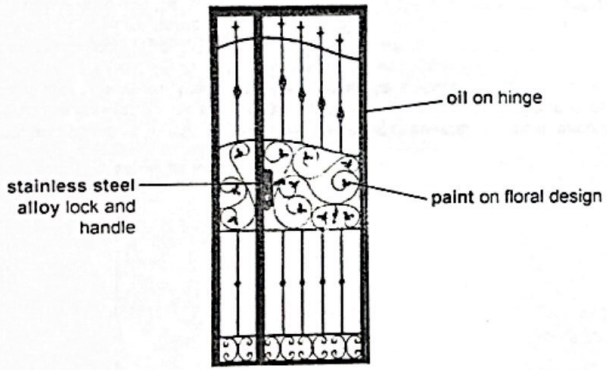
..... [3]

[Total: 11]

A7 The diagram shows the rust prevention methods used on different parts of a wrought iron gate.



(a) Stainless steel alloy is used to make the lock and handle of the gate.
What is meant by the term *alloy*?

.....

..... [1]

A7 (b) Explain how the paint and the oil slow down rusting.

.....

.....

.....

..... [2]

(c) The gate is treated with a spray-on layer that prevents rusting. This spray-on layer contains particles of zinc.
Explain how this layer of zinc prevents rust from forming.

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.....

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..... [2]

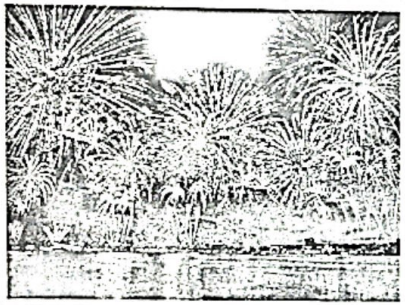
[Total: 5]

Section B

Answer all **three** questions from this section.
The last question is in the form of an either/or and only one of the alternatives should be attempted.

For Examiner's Use

B8 The Chemistry of Fireworks



The sights and sounds of each explosion are the result of several chemical reactions taking place within the firework as it ascends into the sky. Fireworks consist of a mixture of black powder and other chemicals that create the spectacular colours.

What is black powder? Typically, black powder is made up of potassium nitrate, charcoal (carbon) and sulfur in the percentages by mass of 75 : 15 : 10. Each of these components plays an important role in the combustion of the black powder in the form of self-sustaining exothermic reactions that do not rely on oxygen from external sources.

Potassium nitrate acts as an oxidiser, decomposing to potassium oxide, nitrogen gas, and oxygen gas.

$$2KNO_3\,(s) \rightarrow K_2O\,(s) + N_2\,(g) + 2.5O_2\,(g)$$

Oxidisers supplies oxygen to the reducing agents, carbon and sulfur, which serve as a fuel. Carbon and sulfur react with the oxygen to produce carbon dioxide and sulfur dioxide respectively.

$$O_2\,(g) + C\,(s) \rightarrow CO_2\,(g) \quad \Delta H = -393 \text{ kJ / mol of C}$$
$$O_2\,(g) + S\,(s) \rightarrow SO_2\,(g) \quad \Delta H = -2368 \text{ kJ / mol of S}$$

The reactions that produce these gases release a great deal of heat energy, so not only are the gases produced rapidly, they are hot and rapidly expanding gases. This adds to the explosive force of the reaction. More than 10,000 kJ of energy is released for every kilogram of black powder used, and the resulting temperatures can reach 2000°C and beyond!

In recent years, a group of more explosive oxidisers called perchlorates are more commonly used. Perchlorates contain the perchlorate ion (ClO_4^-), in which each chlorine atom is bonded to four oxygen atoms. Perchlorate is able to release all four of its oxygen atoms, making it a better oxidiser than potassium nitrate.

$$KClO_4\,(s) \rightarrow KCl\,(s) + 2O_2\,(g)$$

B8 continued

For Examiner's Use

What makes the different colours in fireworks? Fireworks get their colours from metal salts. The colour of the flame depends on the cation; the anion of the salt has no direct influence. The anions however influence the flame brightness, both by increasing it (e.g. nitrates and chlorates) and decreasing it (e.g. carbonates and oxalates). Some examples of metal salts used in fireworks are given in the table.

colour	chemical name	chemical formula
blue	copper(II) carbonate	$CuCO_3$
green	barium carbonate	$BaCO_3$
green	barium chlorate	$Ba(ClO_3)_2$
orange	calcium carbonate	$CaCO_3$
red	strontium oxalate	SrC_2O_4
yellow	sodium nitrate	$NaNO_3$
yellow	sodium oxalate	$Na_2C_2O_4$

The chemistry of fireworks includes the formation of gases that pollute the air. Burning of fireworks releases atmospheric pollutants such as carbon monoxide, sulfur dioxide and nitrogen oxides.

(a) **(i)** Use oxidation states to show that reduction occurs when potassium nitrate acts as an oxidiser.

.....

.....

.....

..... **[1]**

(ii) Use equations from the passage to **explain** why potassium perchlorate is a better oxidiser than potassium nitrate.

.....

.....

.....

..... **[1]**

For Examiner's Use

(b) Black powder contains carbon and sulfur which serve as fuels in fireworks.

(i) Draw an energy profile diagram for the complete combustion of 1 mole of carbon or sulfur.

Your diagram should include:
- the formulae of the reactant(s) and product(s), and
- the value of the enthalpy change for the chosen reaction.

[3]

(ii) Calculate the energy produced by the complete combustion of 1 g of each fuel and use your calculations to show that the total energy released from the complete combustion of the carbon and sulfur content in 1 kg of black powder exceeds 10,000 kJ.

[3]

(c) Describe how the colour and the flame brightness of the fireworks produced by mixtures 1 and 2 differ.

Firework mixture 1: CaC_2O_4 and $SrCO_3$
Firework mixture 2: $Ba(NO_3)_2$ and $Cu(ClO_3)_2$

.....

.....

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.....

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..... [2]

(d) State how and why the burning of fireworks leads to the formation of nitrogen oxides.

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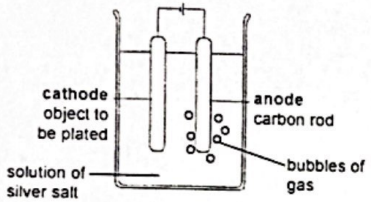
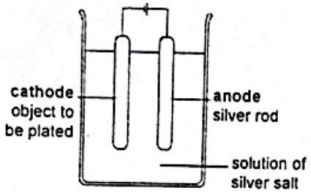
..... [2]

[Total 12 marks]

B9 A student sets up two different experiments for electroplating an object with silver.



Experiment 1



Experiment 2

(a) Suggest a silver salt that can be used as electrolyte for both experiments.

..... [1]

(b) Write equations, with state symbols, to show the reactions that happen at the anode and cathode during each experiment.

Experiment 1

Anode .....

Cathode .....

Experiment 2

Anode .....

Cathode ..... [4]

For Examiner's Use

B9

(c) In **Experiment 1**, 100 cm^3 of the colourless gas was collected at the anode. What is the gain in mass of the cathode?

[3]

[Total: 8]

B10 EITHER

For Examiner's Use

A metallic element, M, has the following properties.

less dense than water
soft
melts below 100 °C
occurs naturally as its chloride, formula MCl
the oxide of M reacts with water to form a soluble hydroxide

(a) (i) Suggest to which Group of the Periodic Table metal M belongs.

.....

(ii) Suggest how metal M can be extracted from its compounds. Explain your reasoning.

.....

.....

.....

..... [3]

(b) Outline a method to prepare crystals of MCl, starting with the carbonate M_2CO_3.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

B10 EITHER continued

(c) 6.72 g of MCl contains 1.42 g of chlorine.
Calculate the number of moles of chlorine atoms in the sample, and hence suggest a value for the relative atomic mass of M.

[3]

[Total: 10]

B10 OR

Ammonia is used to manufacture nitric acid, by a two stage process.

For Examiner's Use

Stage 1: the ammonia is converted to nitrogen(II) oxide.

$$4NH_3\,(g) + 5O_2\,(g) \rightarrow 4NO\,(g) + 6H_2O\,(g) \qquad \Delta H = -950\ kJ/mol$$

(a) State and explain how the **rate** changes when the pressure is increased.
Use ideas about colliding particles.

.....

.....

.....

.....

.....

..... [2]

(b) During the reaction, the ammonia and hydrogen are passed through a powdered catalyst.

(i) Explain why the catalyst becomes hot during the reaction.

.....

..... [1]

(ii) Explain why the catalyst is used in the form of a powder.

.....

..... [1]

B10 OR continued

(c) It is possible to find out whether this reaction has finished by following the pH changes during the reaction. Samples of gas are taken from the reaction vessel at intervals and bubbled through water to form a solution. The pH of each solution is measured.

Explain why the measured pH changes during the reaction.

.....

.....

.....

.....

.....

..... [2]

Stage 2: the nitrogen dioxide is converted to nitric acid.

$$4NO\,(g) + 2H_2O\,(g) + 3O_2\,(g) \rightarrow 4HNO_3\,(aq)$$

(d) Calculate the maximum mass of nitric acid which can be made from 720 dm^3 of nitrogen(II) oxide, NO, at room temperature and pressure.

[3]

(e) Use the two equations in Stage 1 and 2 to construct an **overall** equation for the conversion of ammonia to nitric acid.

..... [1]

[Total: 10]

**********End of Paper**********

1 A student writes down the following procedure:

1. Add water to mixture
2. Filter the mixture
3. Crystallise filtrate to obtain crystals

Which one of the underlined substances in the mixtures below can be collected by using the procedure above?

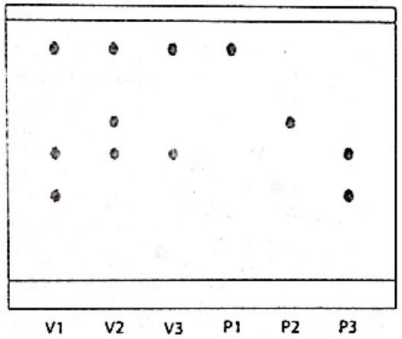
A sodium bromide and sand

B graphite and calcium chloride

C calcium sulfate and glucose

D sodium chloride and iodine

2 The diagram below is a chromatogram from a laboratory. P1, P2 and P3 are known substances while V1, V2 and V3 are unknown substances. What can be deduced from the chromatogram?



1 V1 is a mixture of P1 and P3
2 V2 is a mixture of P1, P2 and P3
3 V3 is a mixture of P1 and P2

A 1 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

3 Which of the following apparatus is best for transferring 25.0 cm^3 of solution from a conical flask to a beaker?

A burette

B measuring cylinder

C pipette

D beaker

4 A student added aqueous sodium hydroxide to a colourless solution and obtained a white precipitate which is insoluble in excess. He took another sample of the colourless solution, added acidified silver nitrate solution to it and obtained a yellow precipitate. What could be the identity of the compound present in the colourless solution?

A zinc chloride

B copper(II) iodide

C aluminium chloride

D calcium iodide

5 3 drops of each of the following food colouring were placed in separate beakers, each containing the same volume of water at room temperature. Which beaker of food colouring would take the longest time to obtain a homogeneous colour without stirring?

	name of food colouring	*molecular formula*
A	Brilliant Blue FCF	$C_{37}H_{34}N_2Na_2O_9S_3$
B	Erythrosine	$C_{20}H_6I_4Na_2O_5$
C	Allura Red AC	$C_{18}H_{14}N_2Na_2O_8S_2$
D	Sunset Yellow FCF	$C_{16}H_{10}N_2Na_2O_7S_2$

6 Element X forms a solid compound XO_2 at room temperature. Which element is likely to be X?

A carbon

B magnesium

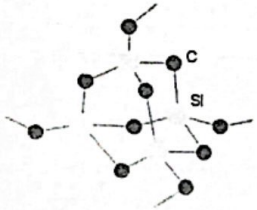
C manganese

D sulfur

7 Which of the following particles is an isotope of $^{16}_{8}O$?

	proton number	*nucleon number*	*charge*
A	8	16	2-
B	8	18	2-
C	6	16	0
D	6	18	0

8 Silicon carbide has the following structure:



What will be a property of silicon carbide?

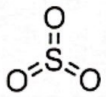
A good electrical conductor

B low melting and boiling points

C insoluble in water

D acts as a lubricant

9 In a molecule of sulfur trioxide, how many electrons in the outer shell of all the oxygen atoms are not involved in bonding?



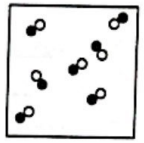
A 6

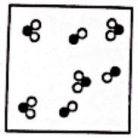
B 12

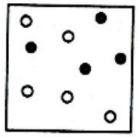
C 18

D 24

10 Which of the following shows a mixture of an element and a compound?

A 

C 

B 

D 

11 Both calcium chloride and potassium chloride are ionic compounds.
Which statements about these compounds are correct?

1 Potassium chloride has a higher melting point than calcium chloride because the potassium ion has a greater charge than the calcium ion.

2 In the calcium chloride lattice, the ratio of calcium ions to chloride ions is half that of the ratio of potassium ions to chloride ions in the potassium chloride lattice.

3 Molten calcium chloride has a greater electrical conductivity than molten potassium chloride because calcium contributes more electrons to the delocalised 'sea of electrons' than potassium does.

A 1 and 2

B 1 and 3

C 2 only

D 3 only

12 The chemical equation for the combustion of a particular compound, $C_{15}H_{32}$, is given below.

$$C_{15}H_{32} + x\,O_2 \rightarrow 15\,CO_2 + y\,H_2O$$

What are the values for x and y to make this equation balanced?

	x	*y*
A	23	16
B	31	16
C	23	32
D	31	32

13 An impure sample of calcium carbonate was reacted with hydrochloric acid. If it is known that the percentage purity of the calcium carbonate sample is 88%, and the volume of carbon dioxide gas produced from the reaction is 1 dm^3 at r.t.p., calculate the mass of the impure sample.

A $\frac{1}{24000} \times 100 \times \frac{100}{88}$

B $\frac{1}{24000} \times \frac{100}{88}$

C $\frac{1}{24} \times 100 \times \frac{100}{88}$

D $\frac{1}{24} \times \frac{100}{88}$

14 Water can be made from a chemical reaction between hydrogen and oxygen. The equation is shown below:

$$2\,H_2(g) + O_2(g) \rightarrow 2\,H_2O(g)$$

176 cm^3 of hydrogen was reacted with 84 cm^3 of oxygen. What is the total volume of gas collected at the end of the reaction?

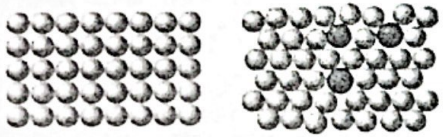
A 84 cm^3

B 92 cm^3

C 168 cm^3

D 176 cm^3

15 An alloy was made form a pure metal. The structures of both substances are shown below.



pure metal

alloy

Which of the following is **not** a property of the alloy?

A It becomes harder than the pure metal.

B It becomes more malleable than the pure metal.

C It becomes stronger than the pure metal.

D It becomes more brittle than the pure metal.

16 The following list shows the reactions of four metals.

metal	reaction
P	reacts readily with cold water.
Q	does not react with steam but reacts with dilute hydrochloric acid
R	reacts readily with steam
S	reacts explosively with hot water but slowly with cold water

Which of the following shows the list of metals arranged in order of increasing reactivity?

least reactive → most reactive

A Q → R → P → S

B S → Q → R → P

C P → S → R → Q

D Q → R → S → P

17 Which one of the following is not an advantage of recycling metals?

A finite resources can be conserved

B pollution problems related to the extraction of metals are reduced

C landfill sites are no longer required

D communities can be educated

18 A student carried out the reaction between ethanoic acid (CH_3COOH) and excess sodium carbonate. The equation is shown below:

$$Na_2CO_3(aq) + 2\,CH_3COOH(aq) \rightarrow 2\,CH_3COONa(aq) + CO_2(g) + H_2O(l)$$

He used a thermometer to measure the temperature of the mixture before and after the solution, taking note that the temperature decreased. Which statement below is correct?

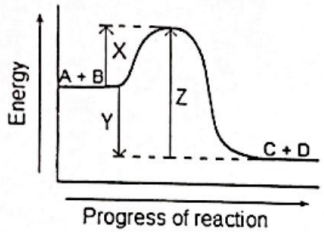
A The reaction is exothermic.

B The products formed are a salt, carbon dioxide gas and water.

C The gas produced turns red litmus paper blue.

D A precipitate is formed during the reaction.

19 The following shows an energy profile diagram of a reaction.



The equation for a reversible reaction is given below

$$A + B \rightleftharpoons C + D$$

Which of the following statements is **not** true about the energy profile diagram?

A X is the activation energy of the forward reaction.

B Y is the enthalpy change of the forward reaction.

C Z is the enthalpy change of the backward reaction.

D The backward reaction is endothermic.

20 Hydrogen peroxide decomposes slowly to water and oxygen. What is the effect of adding manganese(IV) oxide, a catalyst, to the reaction?

A The yield of oxygen increases.

B Hydrogen peroxide reacts with the catalyst to speed up the reaction.

C The catalyst speeds up the rate of reaction by ensuring more collisions.

D The catalyst provides an alternative pathway with a lower activation energy of the reaction.

21 Hornblende is a type of complex mineral with the chemical formula, $Ca_3Fe_5Al_8O_{22}F$.
What is the oxidation state of the iron atom?

A +2

B +3

C +4

D +5

22 Substance S is a solid. It cannot conduct electricity in the solid state. When it is dissolved in water, the solution can conduct electricity.
Which one of the following statements is **not** true for substance S?

A Substance S is an ionic solid.

B Substance S contains ions of opposite charges.

C Substance S is likely to conduct electricity in the molten state.

D Substance S can conduct electricity because of free-moving electrons.

23 Which chemical equation below is a redox reaction?

A $NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$

B $NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$

C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

D $CaCO_3 \rightarrow CaO + CO_2$

24 A student uses aqueous potassium iodide and acidified potassium manganate(VII) to test on two unknown substances, X and Y, separately. He records his observations of the reactions in the table below.

	aqueous potassium iodide	acidified potassium manganate(VII)
substance X	turns brown	remains purple
substance Y	remains colourless	turns colourless

Which row shows the correct process that has taken place in substances X and Y?

	substance X	substance Y
A	oxidation	oxidation
B	reduction	reduction
C	oxidation	reduction
D	reduction	oxidation

25 Which of the following observations does **not** confirm the presence of an acid?

A Gas produced from heating with sodium hydroxide turns red litmus paper blue.

B Gas produced from reaction with metal extinguishes a lighted splint with a 'pop' sound.

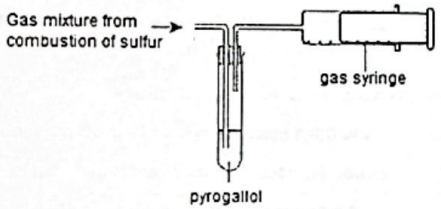
C Gas produced from reaction with carbonate forms a white precipitate in limewater.

D Universal indicator turns red when added.

26 Sulfur burns in air to form sulfur dioxide according to the following equation.

$$S + O_2 \rightarrow SO_2$$

A scientist burns some sulfur powder in excess pure oxygen. He takes the remaining gas at room temperature and pressure and bubbles it through excess pyrogallol, as shown below.



Pyrogallol is an alkaline solution which absorbs oxygen gas. Which of the following shows the gas(es) that will be collected in the syringe?

A sulfur dioxide and oxygen

B sulfur dioxide

C oxygen

D none of the above

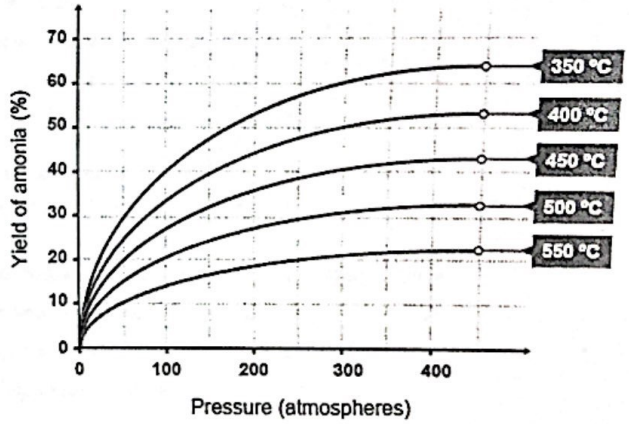
27 Which method and reagents will be the most suitable for preparing a sample of zinc chloride?

	method	reagents
A	acid with excess insoluble reactant	zinc hydroxide and hydrochloric acid
B	titration	zinc hydroxide and hydrochloric acid
C	acid with excess insoluble reactant	zinc nitrate and hydrochloric acid
D	precipitation	zinc nitrate and hydrochloric acid

28 In the Haber process, nitrogen and hydrogen are reacted to form ammonia. How is nitrogen and hydrogen obtained respectively?

	nitrogen	hydrogen
A	fractional distillation of air	fractional distillation of air
B	fractional distillation of air	cracking of crude oil
C	cracking of crude oil	reacting metal with acid
D	cracking of crude oil	cracking of crude oil

29 The Haber process is carried out at 250 atmospheres and 450 °C.



According to the graph, at 250 atmospheres, the yield of ammonia is highest at 350 °C. What is the reason why the Haber process is carried out at 450 °C instead?

A The low temperature requires expensive equipment to withstand the heat.

B The rate of reaction would be much slower at 350 °C.

C The high pressure causes a slower rate of reaction.

D A low pressure would cause the gases to leak out.

30 Which statement about the ions of Group VI elements is correct?

A All the ions contain more electrons than protons.

B All the ions contain more protons than neutrons.

C All the ions contain more neutrons than protons.

D All the ions contain an odd number of electrons.

31 Three elements J, K and L have consecutive increasing proton numbers. They are from the first 30 elements in the Periodic Table. If element L reacts explosively with water, what will the chemical symbol of element J be in its compounds?

A J^{3+}

B J^{+}

C J^{3-}

D J^{-}

32 Which statement about the Periodic Table is **not** true?

A The elements become less metallic across the period.

B The valency of the elements increases across the period.

C The number of electron shells increase down the group.

D The oxides formed by the elements become more acidic across the period.

33 Which of the air pollutant is **not** matched correctly to its source?

	air pollutant	source
A	carbon monoxide	incomplete combustion of fuels
B	nitrogen dioxide	internal combustion engines of cars
C	sulfur dioxide	lightning activity
D	sulfur dioxide	combustion of fuels

34 The carbon cycle consists of a few processes that either contributes or removes carbon dioxide from the atmosphere.
Which of the following is correct?

	process producing carbon dioxide	process removing carbon dioxide
A	photosynthesis	respiration
B	burning of fossil fuels	respiration
C	burning of fossil fuels	photosynthesis
D	respiration	burning of fossil fuels

35 Which of the following is **not** a method for reducing the effects of acid rain?

A liming rivers and lakes

B using flue gas desulfurisation processes in factories

C installing a catalytic converters on cars

D reduce the usage of chlorofluorocarbon based products

36 In the electrolysis of dilute sodium chloride solution using graphite electrodes, which product is formed at the anode?

A oxygen gas

B hydrogen gas

C sodium metal

D chlorine gas

37 A metal is less reactive than sodium and has a melting point of 1085 °C. The metal forms a black compound when burnt in air. Which of the following could be the metal?

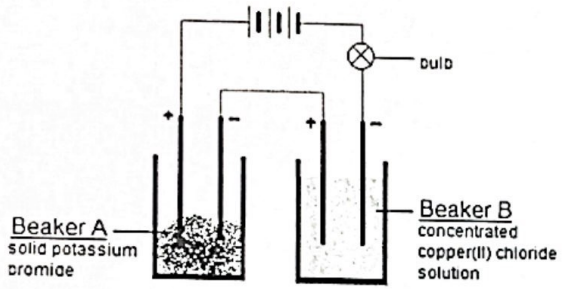
A aluminium

B lead

C copper

D calcium

Refer to the diagram below for Questions 38 and 39.
The circuit was set up by a student. In both beakers, graphite electrodes were used.



38 The student observed that the bulb was unlit. When he added water to the solid potassium bromide, the bulb lit up. What was the reason for the bulb **not** being lighted in the first place?

A There were no mobile electrons in beaker A.

B There was too little water in beaker B

C There were no mobile ions in beaker A.

D There was too much water in beaker B.

39 What are the half equations for the cathode reactions on both beakers A and B?

	beaker A	beaker B
A	$2H^+ + 2e^- \rightarrow H_2$	$Cu^{2+} + 2e^- \rightarrow Cu$
B	$2H^+ + 2e^- \rightarrow H_2$	$2H^+ + 2e^- \rightarrow H_2$
C	$K^+ + e^- \rightarrow K$	$2H^+ + 2e^- \rightarrow H_2$
D	$K^+ + e^- \rightarrow K$	$Cu^{2+} + 2e^- \rightarrow Cu$

40 Which of the following is **not** a good way to prevent the rusting of iron?

A galvanising

B attaching a copper block to iron

C painting

D greasing

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