

XINMIN SECONDARY SCHOOL
PRELIMINARY EXAMINATIONS 2020

PAPER 1

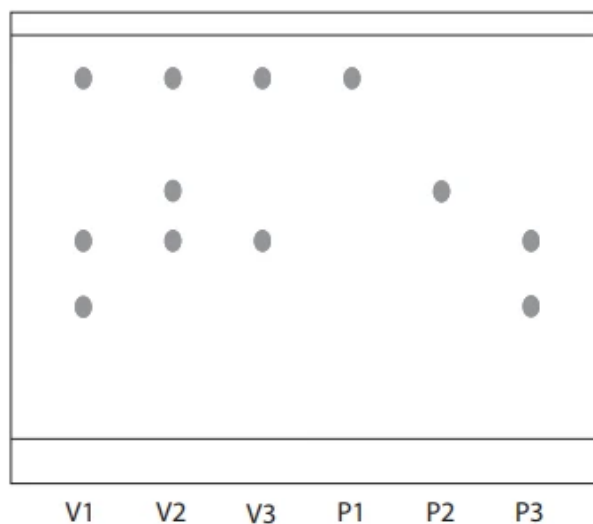
1 A student writes down the following procedure:

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?

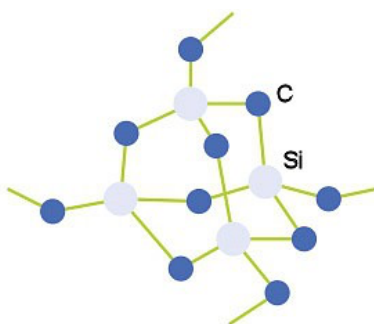
	<i>name of food colouring</i>	<i>molecular formula</i>
A	Brilliant Blue FCF	$\text{C}_{37}\text{H}_{34}\text{N}_2\text{Na}_2\text{O}_9\text{S}_3$
B	Erythrosine	$\text{C}_{20}\text{H}_{14}\text{I}_4\text{Na}_2\text{O}_5$
C	Allura Red AC	$\text{C}_{18}\text{H}_{14}\text{N}_2\text{Na}_2\text{O}_8\text{S}_2$
D	Sunset Yellow FCF	$\text{C}_{16}\text{H}_{10}\text{N}_2\text{Na}_2\text{O}_7\text{S}_2$

- 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 $^{16}_8\text{O}$?

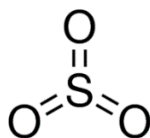
	<i>proton number</i>	<i>nucleon number</i>	<i>charge</i>
A	8	16	2-
B	8	18	2-
C	6	16	0
D	6	18	0

- 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

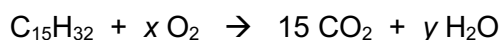
11 Both calcium chloride and potassium chloride are ionic compounds.

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.



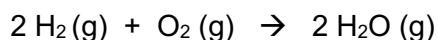
What are the values for x and y to make this equation balanced?

	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 dm³ at r.t.p., calculate the mass of the impure sample.

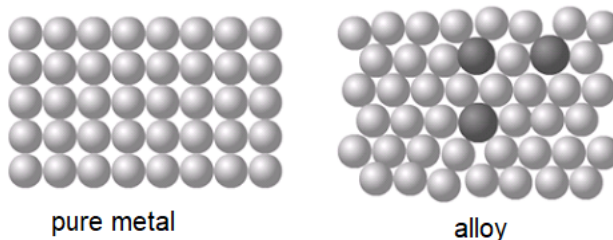
- A $\frac{1}{24000} \times 100 \times \frac{100}{88}$
- B $\frac{1}{24000} \times \frac{100}{88}$
- C $\frac{1}{24} \times 100 \times \frac{100}{88}$
- D $\frac{1}{24} \times \frac{100}{88}$

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



176 cm³ of hydrogen was reacted with 84 cm³ of oxygen. What is the total volume of gas collected at the end of the reaction?

- A 84 cm³
- B 92 cm³
- C 168 cm³
- D 176 cm³
- 15 An alloy was made from a pure metal. The structures of both substances are shown below.



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.

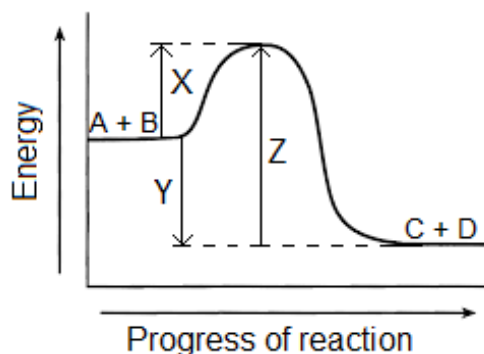
metal	reaction
P	reacts readily with cold water.
Q	does not react with steam but reacts with dilute hydrochloric acid
R	reacts readily with steam
S	reacts explosively with hot water but slowly with cold water

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

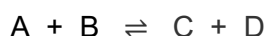
least reactive → most reactive

- A** $Q \rightarrow R \rightarrow P \rightarrow S$
- B** $S \rightarrow Q \rightarrow R \rightarrow P$
- C** $P \rightarrow S \rightarrow R \rightarrow Q$
- D** $Q \rightarrow R \rightarrow S \rightarrow P$
- 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:
- $$\text{Na}_2\text{CO}_3 (\text{aq}) + 2 \text{CH}_3\text{COOH} (\text{aq}) \rightarrow 2 \text{CH}_3\text{COONa} (\text{aq}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{l})$$
- 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



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, $\text{Ca}_3\text{Fe}_5\text{Al}_8\text{O}_{22}\text{F}$. 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** $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$
- B** $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NaCl} + \text{NH}_3 + \text{H}_2\text{O}$
- C** $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- D** $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

- 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

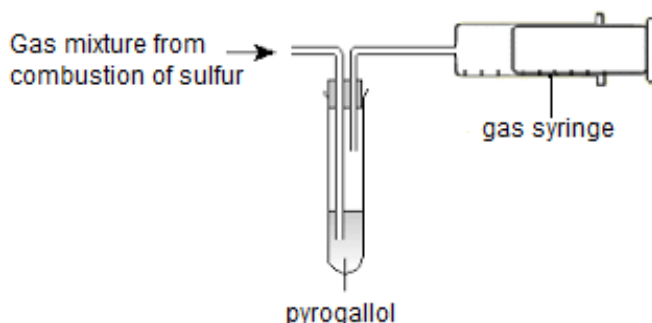
Which row shows the correct process that has taken place in substances X and Y?

	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.



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?

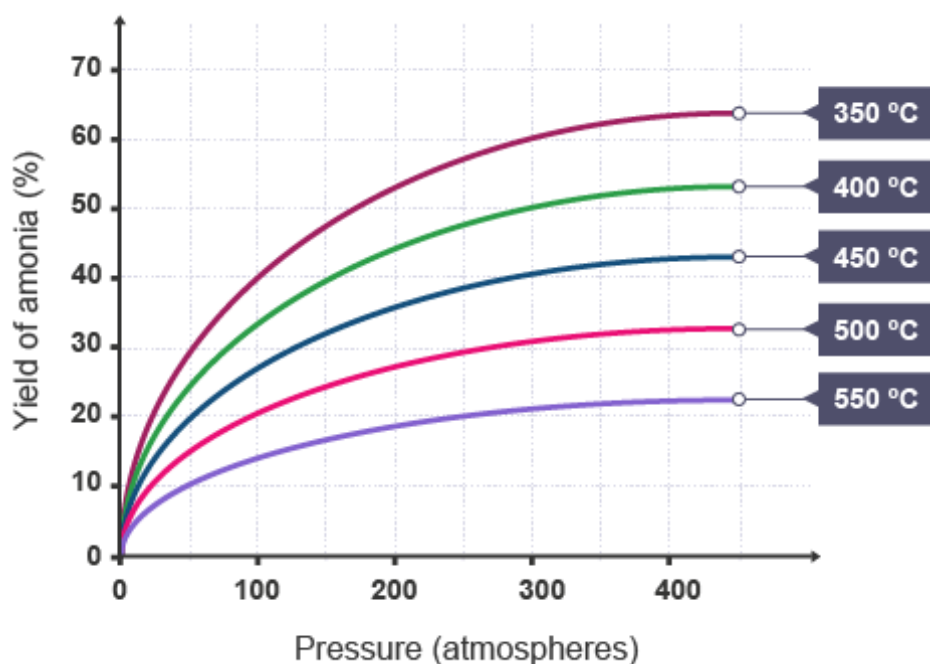
- A sulfur dioxide and oxygen
 - B sulfur dioxide
 - C oxygen
 - D none of the above
- 27 Which method and reagents will be the most suitable for preparing a sample of zinc chloride?

	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?

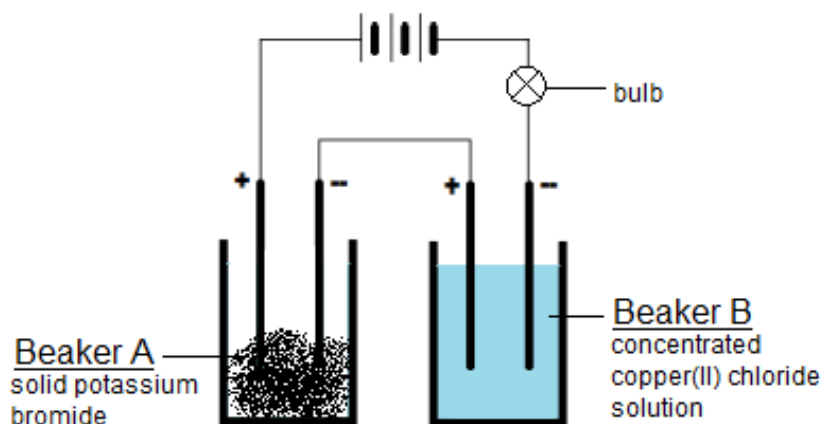
- A oxygen gas
- B hydrogen gas
- C sodium metal
- D chlorine gas

- 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	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
C	$\text{K}^+ + \text{e}^- \rightarrow \text{K}$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
D	$\text{K}^+ + \text{e}^- \rightarrow \text{K}$	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

- 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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