Name: …….. ( ) Class: Sec 4A

Queenstown Secondary School

Preliminary Examination 2020
Secondary Four Express
Chemistry
6092/01

2 September 2020
Wednesday

Time: 1145 – 1245h
Duration: 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
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** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 17.
The use of an approved scientific calculator is expected, where appropriate.

1 Four students each dissolved an indigestion tablet in 100 cm^3 of water.
They carried out titration using 25.0 cm^3 of their solutions with dilute nitric acid, using the same indicator.
The results are shown in the table.

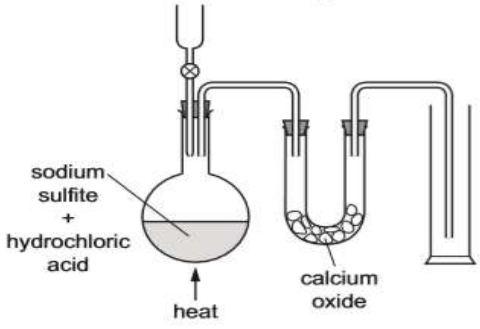
student	1	2	3	4
titration volume / cm^3	20.40	20.30	20.40	22.10

Which statement could explain the result obtained by student 4?

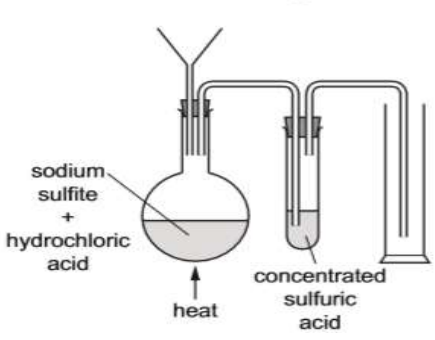
A The burette was washed out with dilute nitric acid.
B The pipette was washed out with the tablet solution.
C The titration flask was washed out with the tablet solution.
D The titration flask was washed out with distilled water.

2 Sulfur dioxide is a gas that is prepared by heating sodium sulfite with hydrochloric acid. It is an acidic gas and is denser than air.
Which set of apparatus is suitable for preparing and collecting a dry sample of sulfur dioxide?

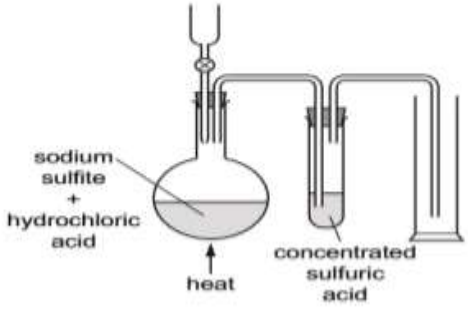
A



C



B



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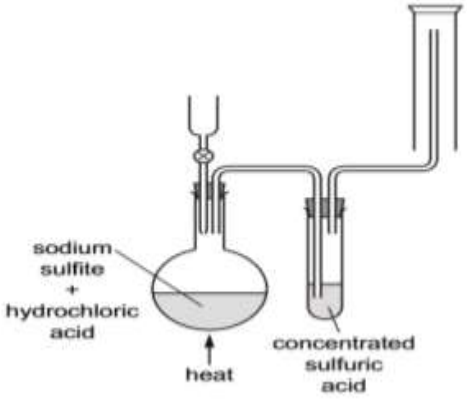


3 A nurseryman's catalogue claims that the beautiful colour of a new rose he is offering for sale is due to the fact that the petals contain the same colouring substance as the flowers of the scarlet geranium. Sai was anxious to test the truth of the claim. He dissolves the colouring substance out of the petals using ethanol.

Which of the following methods would you advise him to do?

A To find out if both solutions have the same pH and if they appear to have the same colour.

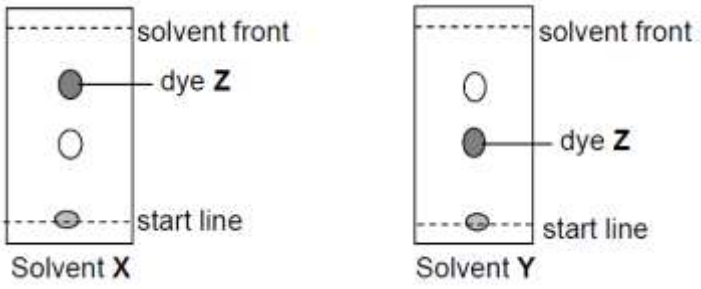
B To find out if both solutions act as indicators with the same colour change in an acidic medium.

C To find out if the solutions can be distilled over at the same temperature.

D To place a few drops of each solution on separate chromatography papers and see how the colouring substance spreads out in a suitable solvent.

4 In a paper chromatography experiment involving some food colouring, two different solvents, X and Y, were used on separate samples of the colouring.

The two chromatograms are shown below.



Which statement can be deduced from the results?

A Dye Z is more soluble in solvent Y than solvent X.

B Dye Z is equally soluble in solvent X and solvent Y.

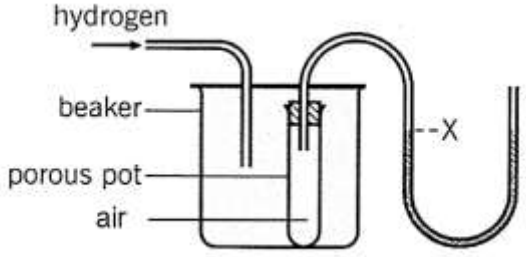
C The distance dye Z travels depends on the solvent used.

D The distance dye Z travels depends on the amount of colouring used.

5 Seawater contains sodium ions and chloride ions.
Which of the following can be used to measure the amount of chloride ions present in a sample of seawater?

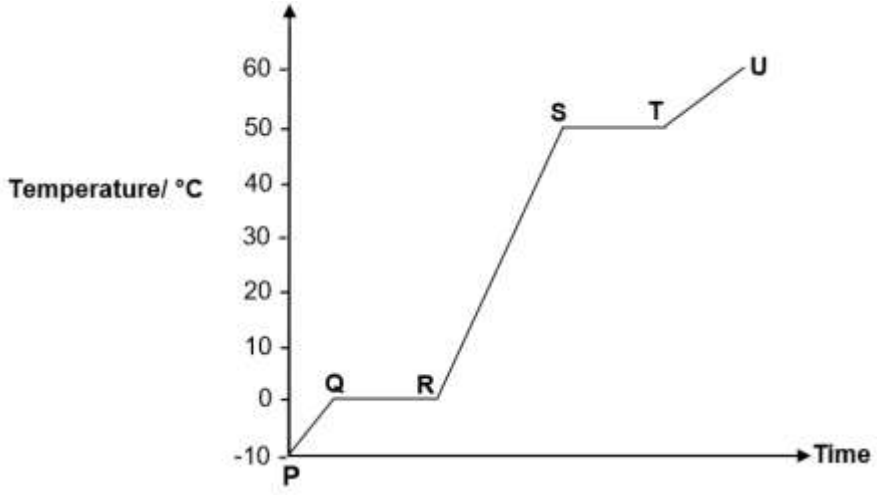
A measure the electrical conductivity of the sample
B heat the sample and weigh the mass of the remaining residue
C add excess aqueous silver nitrate, dry and weigh the mass of the residue formed
D add excess aqueous barium nitrate, dry and weigh the mass of the residue formed

6 The apparatus can be used to show the diffusion of gases. Air is present in the porous pot. The beaker is filled with hydrogen.
Assume all gases are at the same temperature and pressure.



What would happen to the water level at X over time?
A The water level at X will remain unchanged.
B The water level at X will drop and remains there.
C The water level at X will rise and then return to its original position.
D The water level at X will drop and then return to its original position.

7 The graph shows the change in the temperature of a substance with time when it is heated from −10 °C to 60 °C.



Which of the following correctly describes the change taking place between the points?

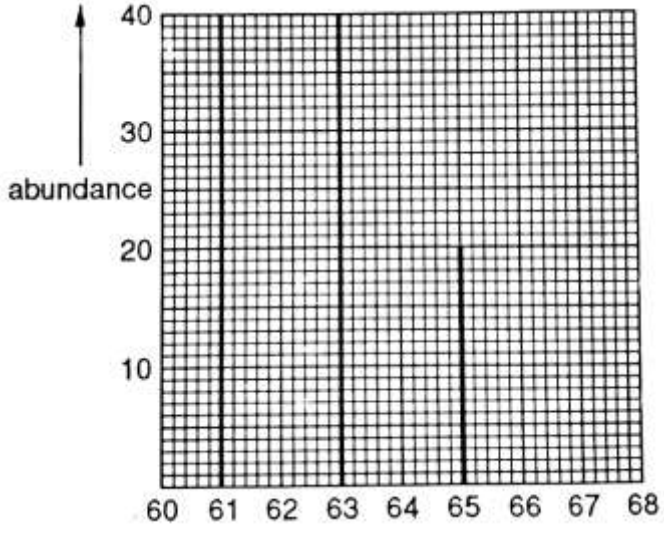
A Energy is released from points P to Q.

B Kinetic energy of the particles remains constant from points P to U.

C Particles gain energy to weaken the forces of attraction from points S to T.

D There is a large increase in the volume of the substance from points R to S.

8 The atomic mass spectrum of an element is shown in the figure below.



What is the relative atomic mass of the element?

A 60.0 **B** 61.1 **C** 62.6 **D** 64.5

9 The table shows information about partices R and S.

particle	number of		
	protons	neutrons	electrons
R	11	12	10
S	19	20	18

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

A Both are atoms from the same group.

B Both are isotopes of the same element.

C Both are positive ions from the same group.

D Both are positive ions from different groups.

10 Excess liquid bromine is added to a mixture of sodium chloride and sodium iodide solutions in a beaker.

Which particles will be present in the resulting mixture?

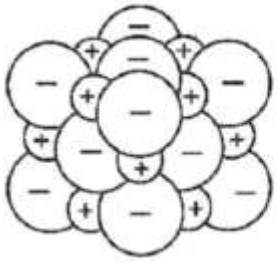
A iodine atoms, sodium ions, chloride ions and bromide ions

B iodine atoms, sodium atoms, chlorine atoms, bromine atoms

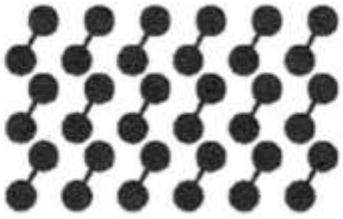
C bromide ions, sodium ions, iodine molecules and bromine molecules

D iodine molecules, sodium ions, chloride ions, bromide ions and bromine molecules

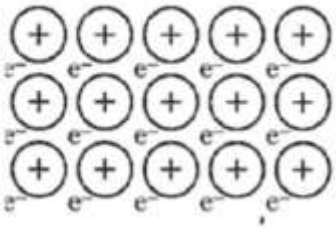
11 The structures of three substances P, Q and R are shown below.



P



Q



R

Which statements are correct?

1 P and R can conduct electricity in the molten state.
2 Q is an element while P and R are compounds.
3 P and R have giant structures while Q has a simple structure.

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

12 Powdered calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.

Which is the correct ionic equation, including state symbols, for this reaction?

A $CaCO_3$ (s) + 2HC*l* (aq) → $CaCl_2$ (aq) + H_2O (*l*) + CO_2 (g)
B Ca^{2+} (aq) + CO_3^{2-} (aq) + $2H^+$ (aq) → Ca^{2+} (aq) + H_2O (*l*) + CO_2 (g)
C CO_3^{2-} (aq) + $2H^+$ (aq) → H_2O (*l*) + CO_2 (g)
D $CaCO_3$ (s) + $2H^+$ (aq) → Ca^{2+} (aq) + H_2O (*l*) + CO_2 (g)

13 Which of the following has the highest percentage of nitrogen?

A $(NH_4)_2SO_4$ **B** $(NH_4)_3PO_4$ **C** $CO(NH_2)_2$ **D** NH_4NO_3

14 If 20 cm^3 of the gaseous oxide of element W requires 30 cm^3 of oxygen for complete combustion to produce 40 cm^3 of the gaseous oxide WO_2, what is the molecular formula of the original oxide?

A WO **B** W_2O_3 **C** W_2O **D** W_2O_5

15 50 cm^3 of 0.1 mol/dm^3 of aqueous iron(III) nitrate was mixed with 50 cm^3 of 0.2 mol/dm^3 of aqueous sodium hydroxide in a beaker.

What are the products obtained at the end of the reaction?

A red-brown precipitate and a colourless solution

B green precipitate and a colourless solution

C red-brown precipitate and a yellow solution

D green precipitate and a yellow solution

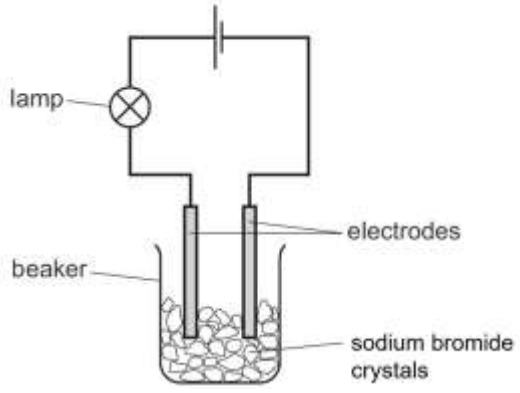
16 Hydrogen peroxide is one of the disinfectants used to disinfect hospitals.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

When 68 g of an impure sample of hydrogen peroxide decomposes, 21 dm^3 of oxygen is obtained. What is the percentage purity of the hydrogen peroxide?

A 87.5% **B** 57.1% **C** 43.8% **D** 65.6%

17 The experiment below shows an electrolytic cell. However, the lamp does not light. When the crystals were heated until they melt, the lamp lights.



Which of the following explains this result?

A Metal ions are free to move when the sodium bromide crystals melt.

B Electrons are free to move when the sodium bromide crystals melt.

C Sodium bromide crystals breaks down to form sodium and bromine.

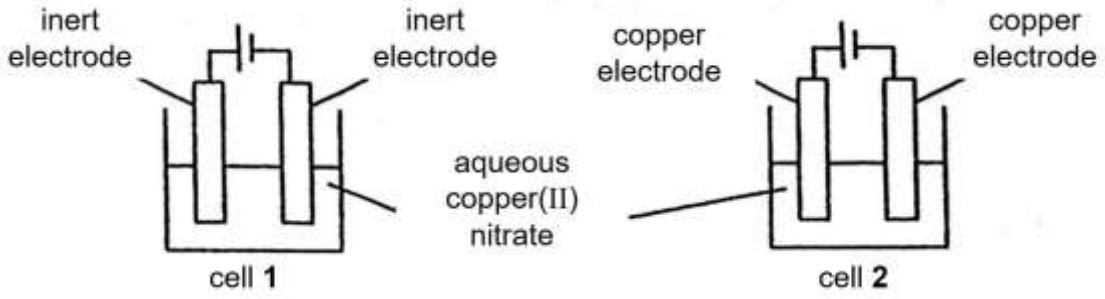
D The ions in sodium bromide were held rigidly in fixed positions before heating.

18 In an electrolysis experiment, the same amount of charge deposited 2.7 g of aluminium and 59.1 g of gold.

What was the charge on the gold ion?

A 1+ **B** 2+ **C** 3+ **D** 4+

19 The diagram below shows two electrolytic cells, 1 and 2.



Which of the following correctly describes cell 1 and cell 2?

	cell 1	cell 2
A	mass of cathode increases	mass of cathode increases
B	mass of anode decreases	mass of anode increases
C	concentration of copper(II) nitrate decreases	concentration of copper(II) nitrate decreases
D	concentration of copper(II) nitrate increases	concentration of copper(II) nitrate remains constant

20 Three electric cells are set up using zinc metal and three unknown metals, U, V and W as electrodes.

The potential differences between the metals are given in the table below.

electric cell	metals used	voltage / V	positive electrode
1	Zn, U	–0.45	Zn
2	Zn, V	+2.71	V
3	Zn, W	+1.11	W

From these results, deduce which arrangement correctly lists the metals in the order of decreasing reactivity.

A U, Zn, V, W **B** Zn, U, W, V **C** V, W, Zn, U **D** V, Zn, W, U

21 Consider the following reaction for which the heat of reaction is given:

$$2N_2O_5\ (s) \rightarrow 4N_2\ (g) + 5O_2\ (g) \quad \square\Delta H = -23\ kJ/mol$$

Which of the following statements about the reaction is **not** correct?

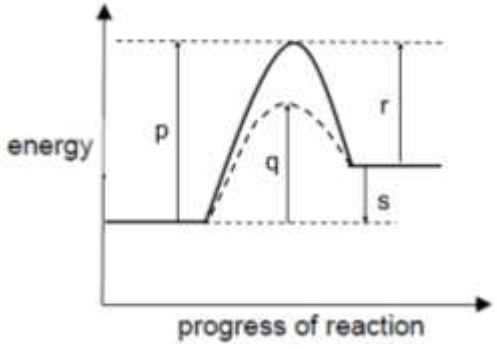
A For each mole of N_2O_5 (s) reacted, 11.5 kJ of heat is released.

B For 2 moles of N_2 (g) produced, 11.5 kJ of heat is released.

C The energy of N_2O_5 is less than that of the products.

D The energy released for bond forming is greater than that absorbed for bond breaking.

22 The following diagram shows an energy profile diagram for a reaction.



Which of the following about the reaction is correct?

A The activation energy of the catalysed reaction is p.

B The enthalpy change of the reaction is r.

C The activation energy of the catalysed reverse reaction is q.

D The enthalpy change of the reverse reaction is s.

23 The table below shows the results of an experiment to show the rate of decomposition of aqueous hydrogen peroxide under different conditions.

experiment	concentration of aqueous hydrogen peroxide / moldm^{-3}	manganese(IV) oxide
1	0.1	powder
2	0.3	lumps
3	0.1	lumps
4	0.2	powder

Which experiments should be used to investigate how surface area of reactants affect the rate of the decomposition?

A 1 and 2 **B** 1 and 3 **C** 1 and 4 **D** 2 and 4

24 Which of the following are effects of an increase in pressure for the following reaction?

$$N_2\,(g) + 2O_2\,(g) \rightarrow 2NO_2\,(g)$$

1 The kinetic energy of the particles increases.
2 The distance between the particles decreases.
3 The speed of the reaction increases.

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

25 Sulfur dioxide is bubbled into aqueous sodium iodide and acidified aqueous sodium manganate(VII).

Which of the following correctly describes the colour change observed?

	aqueous sodium iodide	acidified aqueous sodium manganate(VII)
A	colourless to brown	purple to colourless
B	purple to colourless	colourless to brown
C	remains colourless	purple to colourless
D	remains colourless	remains purple

26 Which of the following series of changes involve both oxidation and reduction?

A $N_2 \rightarrow NO_2 \rightarrow NH_3$
B $Pb \rightarrow PbO \rightarrow PbO_2$
C $MgCl_2 \rightarrow Cl_2 \rightarrow Mg(ClO_4)_2$
D $C_2H_2 \rightarrow C_2H_4 \rightarrow C_2H_6$

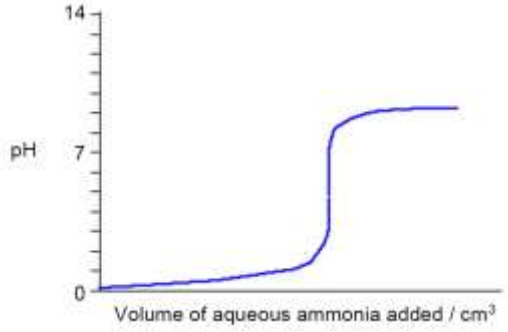
27 Hydrogen fluoride has similar properties to hydrogen chloride.
What are the ions produced when hydrogen fluoride dissolves in water?

A H^+, F^- **B** H_2^+, F_2^- **C** OH^-, F^- **D** H, F

28 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
A	0.3 – 3.0	yellow	violet
B	4.2 – 6.3	red	yellow
C	8.2 – 10.2	colourless	pink
D	11.6 – 14.0	blue	yellow

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?

29 Which of the following shows the correct examples of salts prepared?

	titration	precipitation	adding excess base to warm acid
A	Na_2SO_4	$BaSO_4$	$MgSO_4$
B	CH_3COONa	Ag_2SO_4	$CuSO_4$
C	$(NH_4)_2SO_4$	CH_3COONa	$BaSO_4$
D	AgC*l*	$MgSO_4$	Na_2SO_4

30 Which of the following suggests that the metal oxide, ZO, acts like an amphoteric oxide?

A $ZO + 2H^+ \rightarrow Z^{2+} + H_2O$

B $ZO + 2OH^- \rightarrow ZO_2^{2-} + H_2O$

C $ZO + H_2O \rightarrow Z^{2+} + 2OH^-$

D $ZO + NH_4^+ \rightarrow Z^{2+} + H_2O + NH_3$

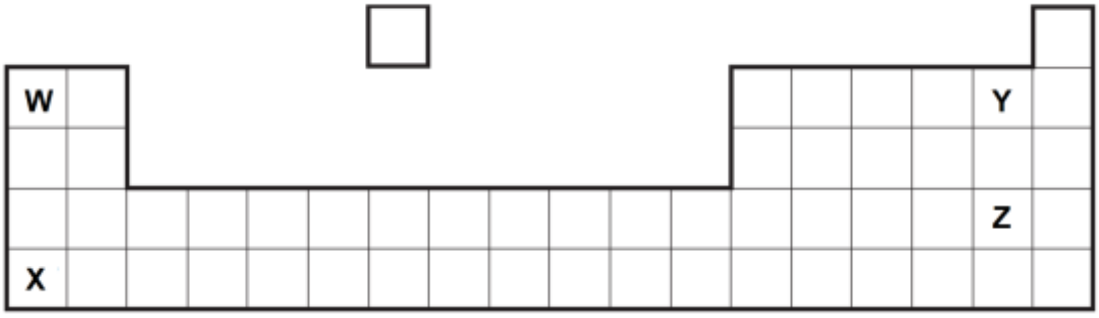
31 Which of the following statements about ammonia is correct?

A It turns damp blue litmus paper red and it is alkaline.
B Sodium hydroxide reacts with ammonium chloride to form ammonia.
C Nitrogen, obtained from the cracking of oil, is needed to form ammonia.
D Hydrogen, obtained from the fractional distillation of air, is needed to form ammonia.

32 Selenium has 6 valence electrons in its atom.
Which of the following is **not** true for selenium?

A It is in the same period as astatine.
B It has four electron shells.
C It is in the same group as sulfur.
D It forms a compound with chemical formula Na_2SeO_4.

33 The diagram below shows a part of the Periodic Table.



Which of the following is correct?

A W has a lower melting point than X.
B W and Z form a compound with a formula of WZ_2.
C Z has a higher boiling point than Y.
D Z reacts more vigorously with W than with X.

34 Manganese has variable oxidation states and forms coloured compounds.
Compounds containing Mn^{4+} ions are usually brown or black in colour.
Compounds containing Mn^{2+} ions are colourless or pale pink in colour.
Compounds containing Mn^{6+} ions are usually green in colour.

Which statement is correct?

1 Manganese has a high density.
2 Manganese compounds are unlikely to be catalysts.
3 Manganese has high melting and boiling points.
4 If a manganese compound changes colour from green to pale pink, reduction has occurred.

A 1, 2 and 3 **B** 2 and 3 **C** 1 and 4 **D** 1, 3 and 4

35 An alloy reacts with dilute nitric acid to produce hydrogen gas.
The red-brown solid that remained forms a black solid when heated strongly in air.

Which of the statement is true about the alloy?

A It contains copper and iron.
B It contains copper and silver
C It contains iron and zinc.
D It contains silver and zinc.

36 Some grey zinc powder were placed in a beaker of aqueous silver nitrate.
Silver solids were deposited on the grey zinc powder.

Which statement is correct?

A Zinc is reduced.
B The mass of silver solid formed decreases.
C The total number of positive ions in the solution decreases.
D The total number of negative ions in the solution decreases.

37 The table below shows the reactivity of four metals and their compounds.

metal	addition of dilute sulfuric acid to the metal	heating hydrogen with the metal oxide	adding metal to the aqueous sulfate of metal J
G	effervescence	metal G formed	no reaction
H	no reaction	metal H formed	no reaction
I	effervescence	no reaction	metal J formed
J	effervescence	no reaction	no reaction

What is the order of thermal stability of the metal carbonates from the most to the least stable?

A H, G, J, I **B** H, J, G, I **C** I, J, G, H **D** I, G, H, J

38 The following gases can be found in the blast furnace that used to extract iron.

1 Carbon monoxide
2 Carbon dioxide
3 Nitrogen

Which of the above gases can be both a reactant and a waste gas?

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

39 The table below shows the composition of the atmosphere in a new planet Covida.

gas	percentage by volume
oxygen	24
nitrogen	73
carbon dioxide	3

Which gases are present in the atmosphere of Covida in a higher percentage as compared to that in the Earth's atmosphere?

A nitrogen only
B oxygen and nitrogen
C carbon dioxide only
D oxygen and carbon dioxide

40 Diesel and petrol are commonly used as fuels for cars. The combustion of these fuels produces air pollutants. The table below shows the mass of air pollutants found in exhaust fumes when 1 kg of each fuel is combusted under identical conditions.

air pollutant produced	mass of air pollutant after diesel is combusted / g	mass of air pollutant after petrol is combusted / g
carbon monoxide	15	300
unburnt hydrocarbons	20	25
oxides of nitrogen	95	40

Which of the following can be inferred from the above data?

A Burning of petrol contributes more towards acid rain.

B Petrol requires less oxygen for complete combustion.

C Combustion of petrol is more exothermic than that of diesel.

D A diesel engine has a higher temperature than a petrol engine.