Name: ..... ( ) Class: Sec 4/5.....

Queenstown Secondary School

Preliminary Examination 2021
Secondary Four Express / Five Normal (Academic)
Science (Physics, Chemistry)
5076/01

1 September 2021
Wednesday

Time: 1000 – 1100h
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.

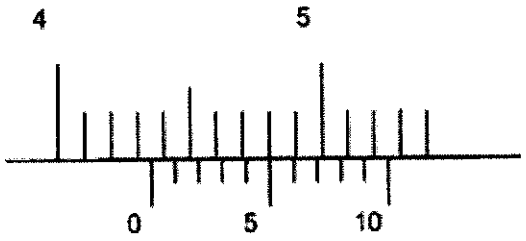
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 Data Sheet is printed on page 16.
A copy of the Periodic Table is printed on page 17
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **17** printed pages.

1 A student uses the vernier calipers to measure the diameter of a coin.
The reading on the scale is shown below.

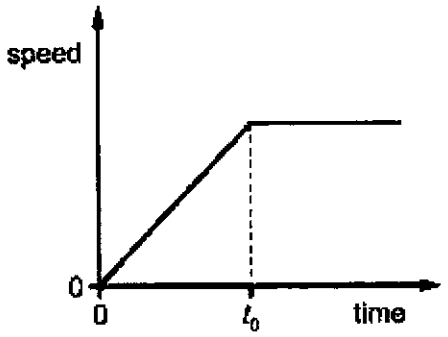


What is the diameter of the coin?

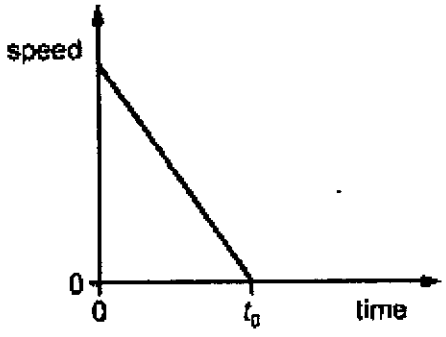
A 4.25 cm **B** 4.35 cm **C** 4.38 cm **D** 4.80 cm

2 A sky diver jumps off a plane and falls through the sky until he reaches constant speed.
Which graph below shows how his speed changes with time until he reaches constant speed?

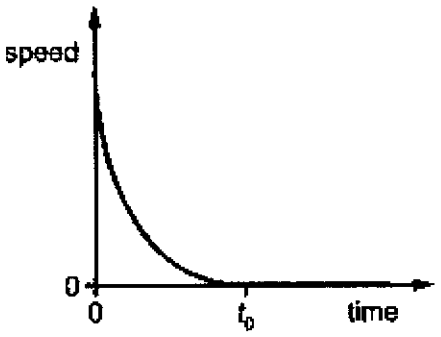
A



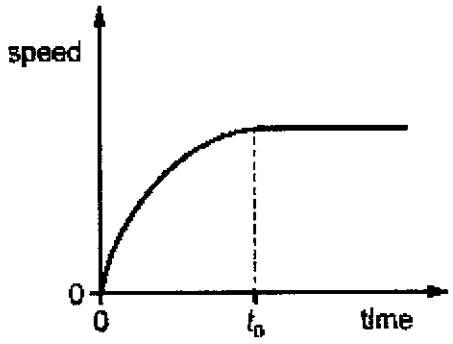
B



C



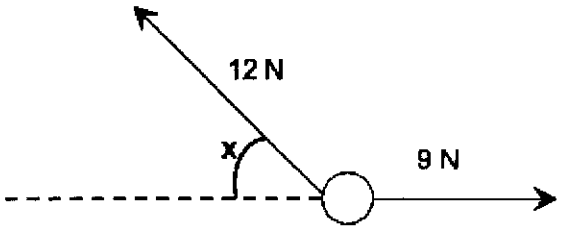
D



3 A deep-sea diver is sinking into deep water at a constant speed of 0.5 m/s.
What is the resultant force acting on the diver if he, together with his diving gear, has a total mass of 100 kg?

A 0 N
B 100 N downwards
C 1000 N downwards
D 1000 N upwards

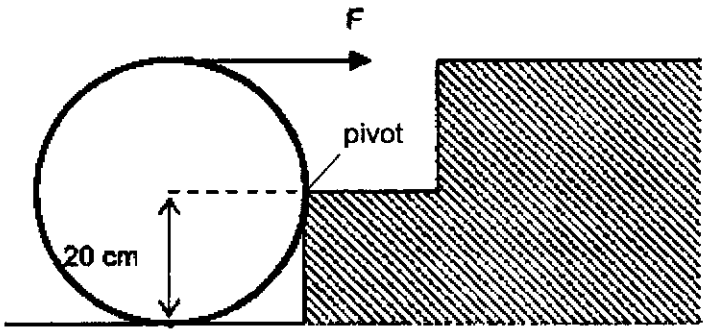
4 The diagram below shows two forces acting on a ball at the same time.
The angle x between the 12 N and 9 N force can vary between 0° and 180°.



Which of the following **cannot** be a possible resultant force on the ball?

A 3.25 N **B** 9 N **C** 21 N **D** 30 N

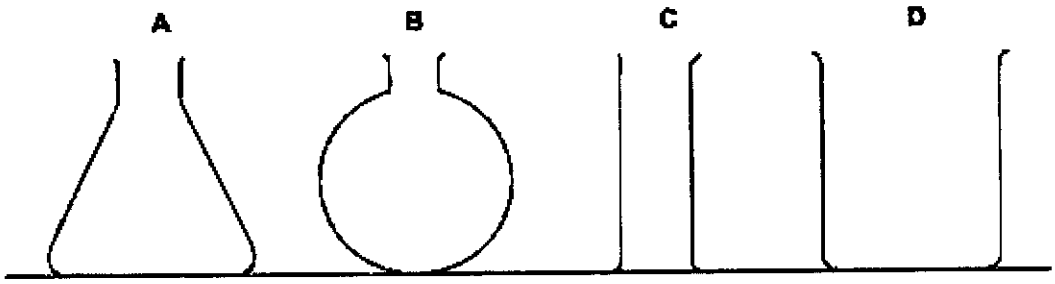
5 The diagram shows a ball of radius 20 cm placed against a step.



If the ball weighs 40 N, what is the minimum force F that can be applied to move the ball up the step?

A 20 N **B** 40 N **C** 800 N **D** 1600 N

6 Which container below is the most stable?



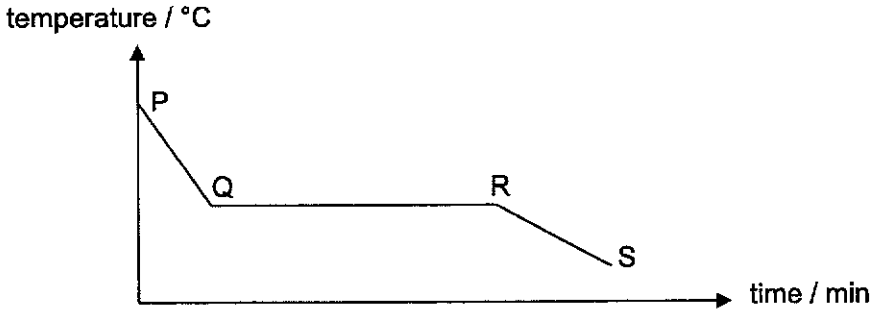
7 A 5 N force is exerted on an object R along a rough surface with a friction of 2 N.
What is the work done to move object R for 10 m on the rough surface?

A 20 J **B** 30 J **C** 50 J **D** 70 J

8 A cold solid is placed on top of a hot solid. The thermal energy flows from the hot solid to the cold one.
Which is the explanation for this?

A Hot particles rises while cool particles sink.
B The particles are free to move randomly through the solids.
C The hot solid expands so its particles will move further apart.
D Thermal energy is passed from one particle to the next through vibrations.

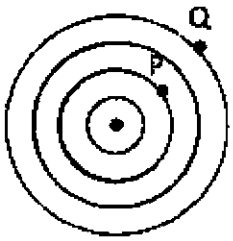
9 Some wax in a test tube was heated till it melted. It was then allowed to cool. The temperature time graph during the cooling process is shown.



Which statement is correct?

A Along PQ, the molecules lose kinetic energy.
B Along QR, the molecules gain potential energy.
C Along QR, the molecules gain kinetic energy.
D Along RS, the molecules lose potential energy.

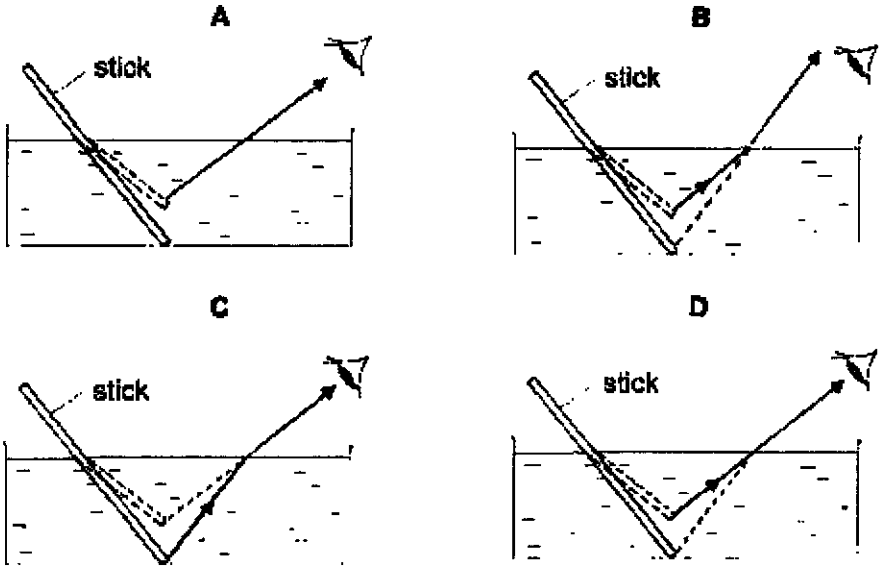
10 Circular water waves are produced by a dot vibrator at a frequency of 4.0 Hz.
The wave pattern at a certain instant is as shown in the diagram below.



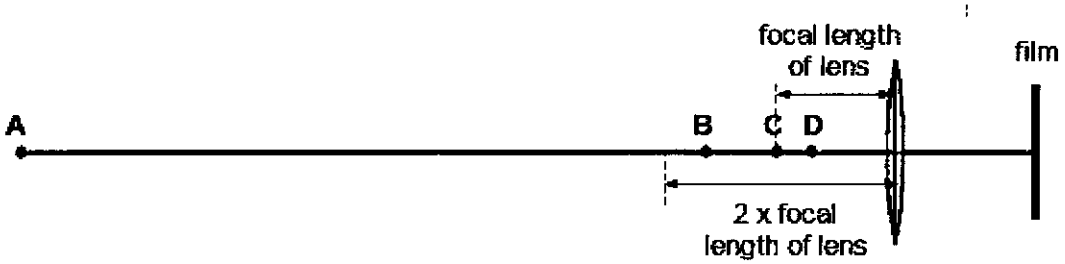
If the speed of the water waves is 0.6 m/s, what is the distance travelled by the wave from point P to point Q?

A 0.15 m **B** 0.30 m **C** 6.67 m **D** 13.3 m

11 Which of the following diagram show the correct ray diagram of how the submerged portion of the stick is seen in the water?



12 The converging lens in a camera is used to make an image on a film.
At which point could an object be placed so that it forms a diminished image?



13 Human body can give off electromagnetic radiation.

Which electromagnetic radiation is emitted by the human body?

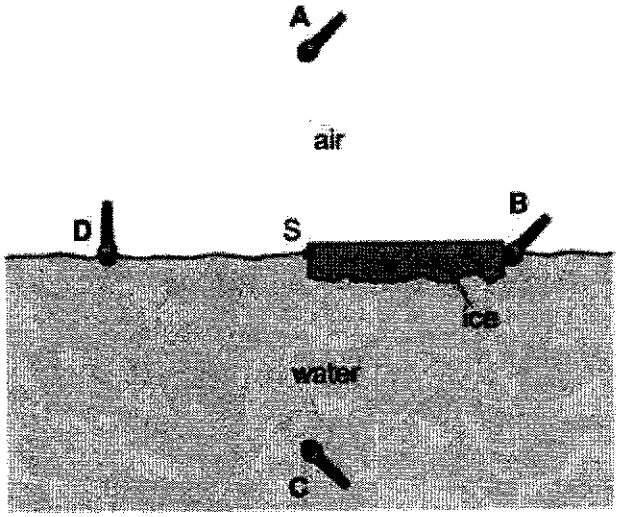
A infrared **B** ultraviolet **C** visible light **D** X-rays

14 A sheet of ice floats on water.

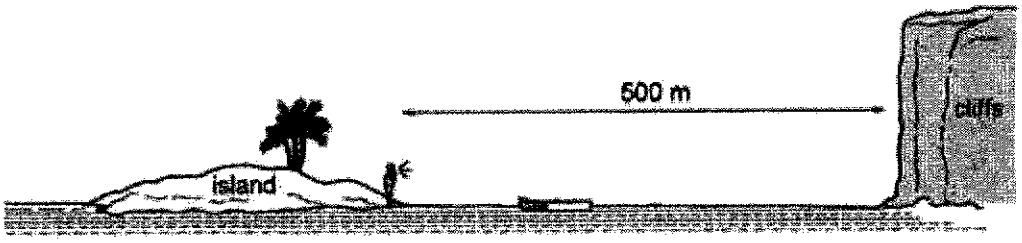
A source of sound is placed as position S at the edge of the ice sheet.

Four microphones are placed at equal distances from S.

Which microphone detects the sound from S **last**?



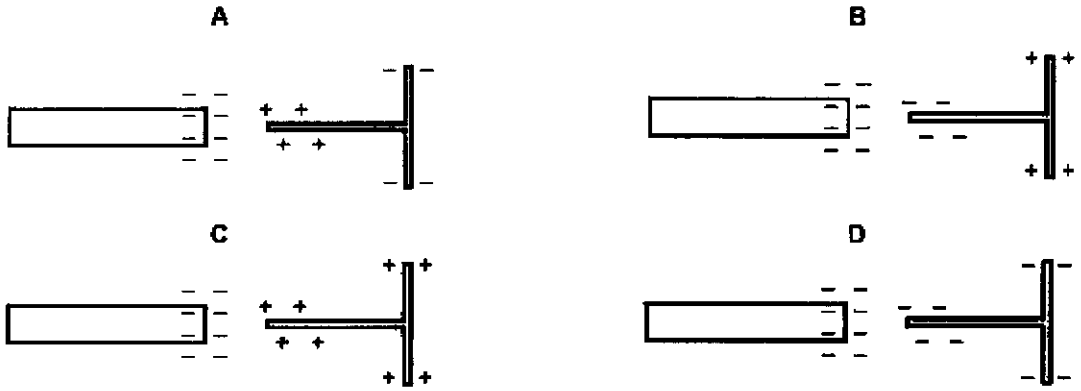
15 A boy is stranded on an island. He shouts for help and hears the echo of his shout from some cliffs that are 500 m away.



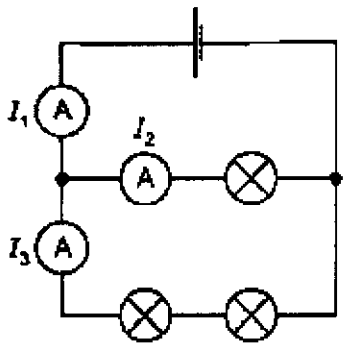
Given that sound travels at 300 m/s through air, what is the time interval between the boy shouting and hearing the echo?

A 0.60 s **B** 1.20 s **C** 1.67 s **D** 3.33 s

16 A negatively-charged rod is brought close to an isolated T-shaped piece of metal.
The metal is uncharged initially.
Which diagram shows the correct charge distribution on the metal after a while?



17 Three identical lamps and three identical ammeters are connected as shown.



The readings on the ammeters are I_1, I_2 and I_3.
How are the readings related?

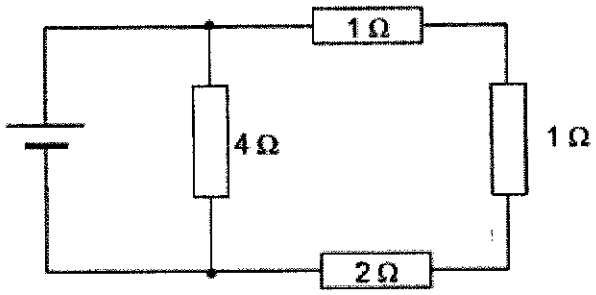
A $I_1 = I_2 = I_3$

B $I_1 > I_2$ and $I_2 = I_3$

C $I_1 > I_3 > I_2$

D $I_1 > I_2 > I_3$

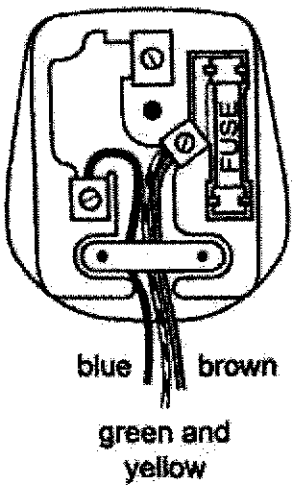
18 The diagram shows four resistors connected to a dry cell.



What is the effective resistance of the circuit?

A 0.364 Ω **B** 0.500 Ω **C** 2.00 Ω **D** 8.00 Ω

19 The internal wiring of a plug is shown below.



What is the effect of using the plug wired this way?

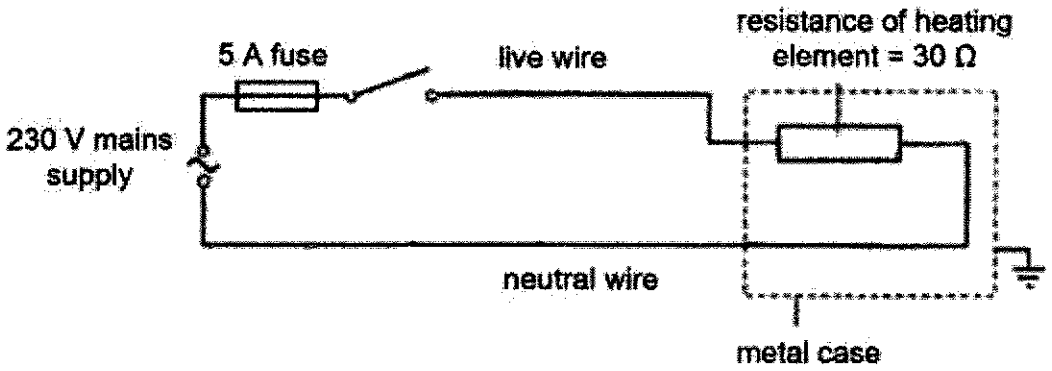
A The appliance will not work.

B The appliance will catch fire.

C The fuse in the plug will blow.

D The metal casing of the appliance will become live.

20 The diagram below shows the circuit of a kettle that is plugged into a mains socket.



What is the fault in the circuit?

A The position of the earth wire should be higher.

B The fuse should be placed on the neutral wire.

C The fuse rating is too low, which will cause the fuse to blow.

D The kettle is still connected to the high voltage terminal even when the switch is open.

21 $50cm^3$ of aqueous sodium thiosulfate reacts with $50cm^3$ dilute hydrochloric acid as shown in the equation below.

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

Sulfur dioxide is soluble in water and is denser than air.

A student wants to collect the sulfur dioxide gas and sulfur precipitate produced.

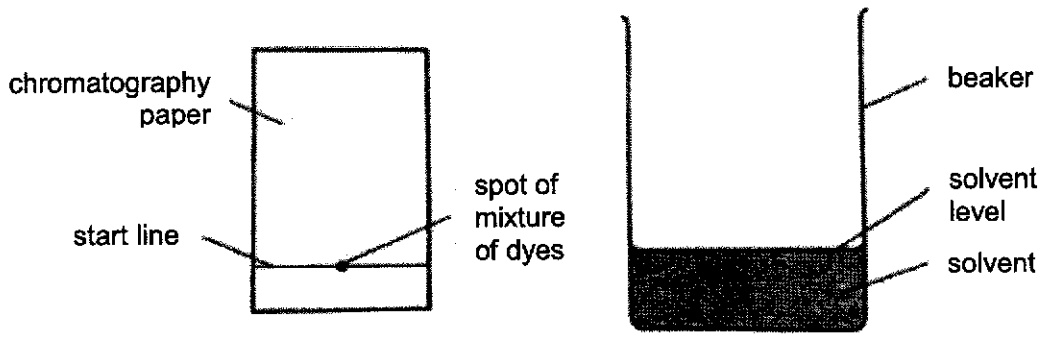
Which gas collection method can be used to collect sulfur dioxide and which apparatus(s) are required for the experiment?

	gas collection method	apparatus(s)
A	displacement of water	filter funnel and paper
B	downward delivery	measuring cylinder, filter funnel and paper
C	upward delivery	burette, filter funnel and paper
D	displacement of water	mass balance, filter funnel and paper

22 An experiment is carried out to separate a mixture of two dyes.

A line is drawn on a piece of chromatography paper and a spot of the mixture of dyes is placed on it.

The paper is dipped into a solvent and left for several minutes.



Which statement about this experiment is correct?

A The dyes must have different colours.

B The start line on the paper must be drawn in pencil.

C The dyes must have the same solubility in the solvent.

D The paper must be placed with the start line below the level of the solvent.

23 Three bottles containing colourless solutions have no labels.

A series of individual tests are carried out on each of the solutions.

Which bottle contains ammonium sulfate solution?

	test 1: add warm sodium hydroxide	test 2: add dilute nitric acid and aqueous barium nitrate	test 3: add dilute hydrochloric acid
A	gas produced turns damp red litmus paper blue	effervescence observed	effervescence observed
B	no visible change	effervescence observed	no visible change
C	gas produced turns damp red litmus paper blue	white precipitate forms	no visible change
D	no visible change	white precipitate forms	effervescence observed

24 The following substances are present on the surface and/or in the atmosphere of Covidium, a newly found planet.

substance	melting point / °C	boiling point / °C
argon	-189	-116
nitrogen	-210	-196
hydrogen	-259	-252

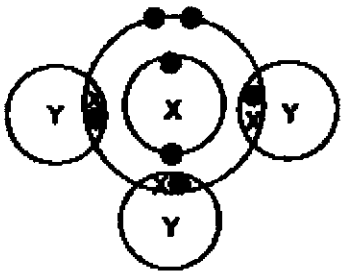
Which of the substance(s) would exist as particles that are closely packed in an orderly manner at -250°C?

A argon only
B argon and nitrogen only
C argon and hydrogen only
D nitrogen and hydrogen only

25 Which of the following statements about atoms and ions is correct?

A The nucleon number of an element is the number of neutrons.
B The number of neutrons and electrons are the same in an atom.
C An atom with atomic number of 5 will lose 3 electrons to form a positive ion.
D Protons have a positive charge while electrons are neutral.

26 The diagram shows the arrangement of electrons of a compound XY_3.



Which statement is **incorrect** about the compound XY_3?

A X atom shares 3 valence electrons with three Y atoms.
B The compound cannot conduct electricity in any physical state.
C Y atom gains an electron from X atom.
D 3 pairs of valence electrons are involved in the bonding of this compound.

27 A nitrate of iron has the formula $Fe(NO_3)_2$.

What is the charge of the iron ion?

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

28 $20cm^3$ of methane, CH_4, are reacted with $30cm^3$ of oxygen.

The equation for the reaction is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

All volumes are measured at r.t.p.

What is the total volume of gas remaining at the end of the reaction?

A $15cm^3$ **B** $20cm^3$ **C** $45cm^3$ **D** $50cm^3$

29 0.6g of magnesium reacted with $100cm^3$ of an unknown concentration of dilute hydrochloric acid.

The equation for this reaction is shown.

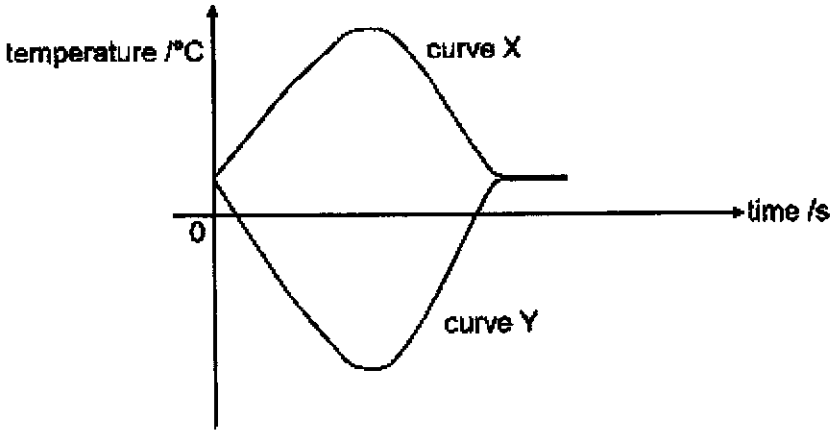
$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

What is the concentration of the dilute hydrochloric acid?

A $0.0005mol/dm^3$ **B** $0.25mol/dm^3$ **C** $0.5mol/dm^3$ **D** $1mol/dm^3$

30 The temperature of a reaction between aqueous sodium hydroxide and dilute sulfuric acid was monitored as the reaction proceeds.

Which of the statement shows the results obtained from the experiment?



A Curve X is correct as the reaction is exothermic.

B Curve Y is correct as the reaction is exothermic.

C Curve X is correct as the reaction is endothermic.

D Curve Y is correct as the reaction is endothermic.

31 100cm^3 of 0.1mol/dm^3 hydrochloric acid were added to a 2g sample of calcium carbonate.

Which of the following changes would increase the initial rate of the reaction without increasing the volume of carbon dioxide formed?

I the addition of 5cm^3 of 2mol/dm^3 hydrochloric acid to the original acid

II raising the temperature

III the use of more finely divided calcium carbonate

A I and II only **B** I and III only **C** II and III only **D** all of the above

32 The equation for the extraction of iron from haematite is as shown below.

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

Which statement accurately explains the process?

A CO is a reducing agent as it is oxidised to form CO_2 with the gain of oxygen.

B CO is an oxidising agent as it is reduced to form CO_2 with the gain of oxygen.

C Fe_2O_3 is a reducing agent as it is reduced to form Fe with the loss of oxygen.

D Fe_2O_3 is an oxidising agent as it is oxidised to form Fe with the loss of oxygen.

33 Which statement about acids and bases is correct?

A Acids react with all metals to form salt and hydrogen.

B Acids turns damp red litmus paper blue.

C Alkalis dissolve in water to form hydroxide ions and their pH is less than 7.

D Alkalis react with ammonium salt to give salt, water and ammonia.

34 Which ionic equation represents the neutralisation of dilute hydrochloric acid and aqueous sodium hydroxide?

A $H^+ + OH^- \rightarrow H_2O$

B $Na^+ + Cl^- \rightarrow NaCl$

C $H^+ + Cl^- \rightarrow HCl$

D $H^+ + O^{2-} \rightarrow H_2O$

35 The oxide of an element X was added to dilute nitric acid and aqueous potassium hydroxide separately.

The word equation for the reactions are shown below.

X oxide + dilute nitric acid → no reaction

X oxide + aqueous potassium hydroxide → salt + water

Which row describes X and its oxide?

	X	X oxide
A	non-metal	basic
B	metal	acidic
C	non-metal	acidic
D	metal	amphoteric

36 Which method is used to prepare silver nitrate?

A adding silver to dilute nitric acid at room temperature

B adding excess silver oxide to warm dilute nitric acid

C titrating silver hydroxide with dilute nitric acid

D precipitating the salt by adding silver chloride to sodium nitrate solution

37 Which of the following statements about the elements in the Periodic Table are correct?

I The melting points decrease from Li to Cs for alkali metals.

II The number of electron shells does not increase across a period.

III Reactivity increases from He to Xe for the noble gases.

IV Halogens exist as diatomic molecules.

V Alkali metals have high density and are soft metals.

A I and II only

B I, II and IV only

C I, III and IV only

D II, IV and V only

38 Which row shows the properties of the element chlorine?

	colour	physical state at room temperature	effect of potassium bromide solution
A	pale yellow	gas	turns red-brown
B	green-yellow	gas	turns red-brown
C	red-brown	liquid	remains colourless
D	black	solid	remains colourless

39 Aluminium is an important metal to mankind.

It is used in storing food items because of its properties.

Which of the following best explains why aluminium metal is used?

A Aluminium extraction requires electrolysis.

B Aluminum is easily recycled.

C Aluminium has a layer of protective oxide.

D Aluminium is a finite resource.

40 Which statements about carbon monoxide are correct?

1 It is produced from the complete burning of natural gas.

2 It reacts with haemoglobin in the blood.

3 It causes acid rain which corrodes limestone buildings.

4 It is a colourless, odourless gas.

A 1 and 2 only

B 1, 2 and 3 only

C 2 and 4 only

D 1 and 3 only

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
					1 H hydrogen 1											2 He helium 4
	3 Li lithium 7	4 Be beryllium 9									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
	11 Na sodium 23	12 Mg magnesium 24									13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
	55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium -	85 At astatine -	86 Rn radon -
	87 Fr francium -	88 Ra radium -	89 – 103 actinoids	104 Rf Rutherfordium -	105 Db dubnium -	106 Sg seaborgium -	107 Bh bohrium -	108 Hs hassium -	109 Mt meitnerium -	110 Ds darmstadtium -	111 Rg roentgenium -	112 Cn copernicium -	114 Fl flerovium -	116 Lv livermorium -				

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium -	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium -	95 Am americium -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

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

Name: ..... ( ) Class: Sec 4/5 .....

Queenstown Secondary School

Preliminary Examination 2021
Secondary Four Express / Five Normal (Academic)
Science (Chemistry)
5076/03

25 August 2021
Wednesday

Time: 1100 – 1215h
Duration: 1 hour 15 minutes

Additional Materials: Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 15.
A copy of the Periodic Table is printed on page16.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Examiner's Use	
Section A	/45
Section B	/20
Q6	
Q7	
Q8	
TOTAL	/65

This document consists of **16** printed pages.

Section A

Answer **all** the questions in the spaces provided.

1 Substance **W** is a mixture of two salts.

Fig. 1.1 describes an attempt by students to identify the salts present in **W**.

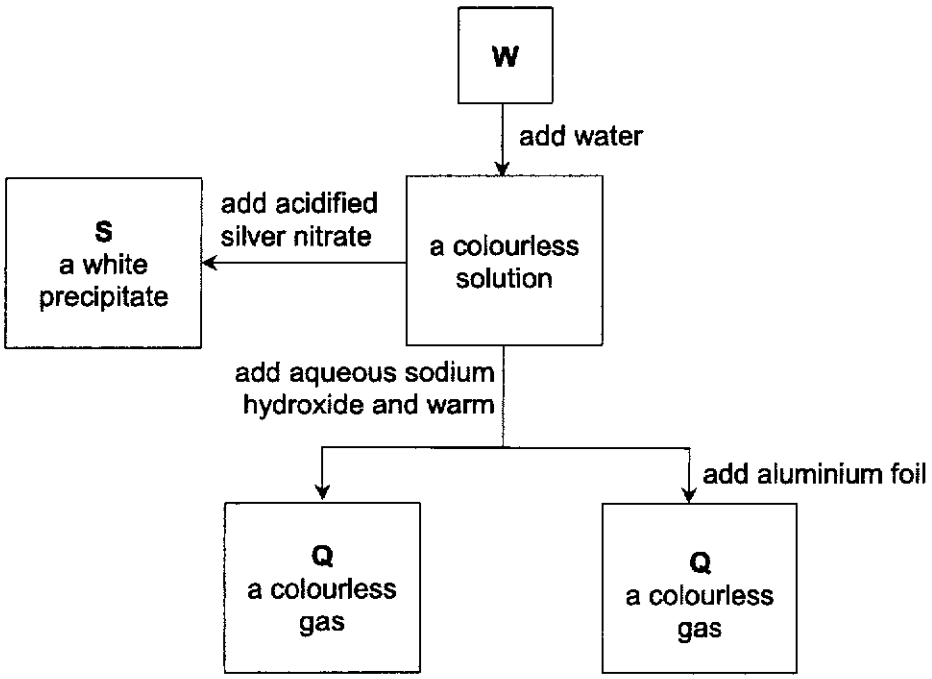


Fig. 1.1

(a) Identify **Q** and **S**.

Q ..... **S** ..... [2]

(b) Name **one** salt that must be present in substance **W**.

..... [1]

(c) Write a balanced chemical equation for any **one** of the reactions included in Fig. 1.1.

..... [2]

(d) When **W** dissolves in water, the temperature of the water decreases.

Explain why this is so.

..... [1]

2 ^{37}Cl is an isotope of chlorine.

(a) An **ion** of ^{37}Cl contains the following particles.

particle	number
X	18
Y	17
Z	20

Table 2.1

Identify particles **X**, **Y** and **Z**.

(i) particle **X** .....

(ii) particle **Y** .....

(iii) particle **Z** ..... [2]

(b) ^{35}Cl is another isotope of chlorine.

Complete Table 2.2 to show the numbers of each type of particle in an **atom** of ^{35}Cl.

particle	number
X	
Y	
Z	

Table 2.2 [1]

(c) The relative atomic mass, A_r, of chlorine is shown as 35.5 on the Periodic Table.

(i) Define the term *relative atomic mass*.

.....

..... [2]

(ii) What can you infer about the relative amounts of the two different isotopes of chlorine?

..... [1]

(d) Chlorine and bromine are elements in the same group.

(i) State **one** similarity between chlorine and bromine.

..... [1]

(ii) State **one** difference between chlorine and bromine, with reference to the kinetic particle theory.

.....

..... [1]

3 Table 3.1 shows some information on the oxides of elements in the same period of the Periodic Table.

proton (atomic) number	11	12	13	14	15	16	17	18
formula of oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10}	SO_2	Cl_2O	no oxide
melting point/ °C	1132	2852	2072	1710	340	–72	–121	

Table 3.1

(a) Name any element from this period and explain how the electronic structure of this element is used to explain the group and period the element is in.

.....

.....

..... [2]

(b) Explain why the element with the proton (atomic) number 18 does not form an oxide.

..... [1]

(c) **(i)** Draw 'dot and cross' diagrams to show the arrangement of the outer shell electrons in sodium oxide, Na_2O, and dichlorine monoxide, Cl_2O.

[Proton (atomic) number: O, 8; Na, 11; Cl, 17]

sodium oxide

[2]

dichlorine monoxide

[2]

(ii) Sodium oxide has a higher melting point than dichlorine monoxide.

You may use your diagrams in answers in **(c)(i)** to help explain this difference.

.....

.....

.....

..... [2]

(d) **(i)** State the amphoteric oxide listed in the table.

..... [1]

(ii) State the oxide that turns purple acidified potassium manganate(VII) colourless.

..... [1]

(iii) In the blast furnace, silicon dioxide, SiO_2, is an acidic impurity present in iron ore. Explain, including chemical equations, how silicon dioxide is removed during the extraction of iron from iron ore.

.....

.....

.....

..... [4]

4 Magnesium and calcium belong to the group of alkaline earth metals.

(a) State **two** physical properties of these metals.

1.....

2..... [2]

(b) Magnesium and thorium are used to make an alloy, mag-thor.

This alloy is used in the aerospace industry.

(i) Define the term *alloy*.

..... [1]

(ii) Mag-thor is much harder than pure magnesium.

Use ideas about the arrangement of atoms in mag-thor to explain why.

.....

.....

..... [2]

(iii) Magnesium oxidises readily when exposed to air, to form magnesium oxide, thus, making it difficult to be recycled. However, recycling of magnesium is still actively encouraged within the industry.

Suggest **two** possible reasons for this.

reason one .....

reason two ..... [2]

(iv) Using the following letters, complete Table 4.1 by writing the letter corresponding to the most appropriate description for each of the substances listed. You may use each letter once, more than once or none at all.

A a pure element,
B a pure compound,
C a mixture of elements,
D a mixture of compounds,
E a mixture of elements and compounds.

substance	description
magnesium	
air	
mag-thor	
magnesium oxide	

Table 4.1 [2]

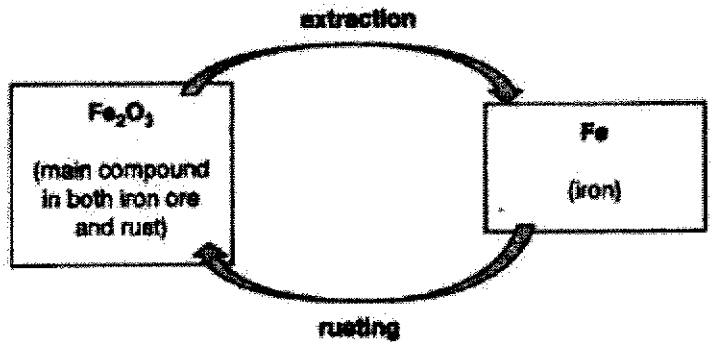
(c) Magnesium can be extracted from its oxide using calcium, but calcium cannot be extracted using magnesium. Suggest why this is so.

.....

.....

..... [2]

5 **(a)** Many parts of a bicycle contain iron. One problem with using iron is that it rusts. The diagram shows the cycle of change that happen when iron is extracted and then rusts.



(i) State the oxidation states of iron in Fe_2O_3 and Fe.

Fe_2O_3 ..... Fe ..... [1]

(ii) Use your answer in **(a)(i)** to show which change involves oxidation and which change involves reduction.

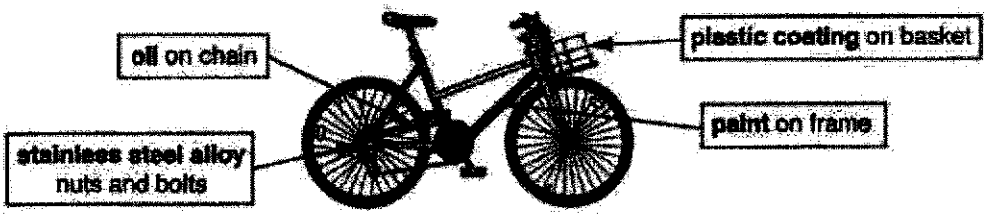
.....

.....

.....

..... [2]

(b) The diagram shows the rust prevention methods used on different parts of a bicycle.



Explain how the oil, the paint and plastic coating slow down rusting.

.....

.....

..... [2]

Section B

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

Write your answers in the spaces provided.

6 **(a)** Students are required to design an experiment to prepare a sample of sodium nitrate solution.

They have made several mistakes.

Read their procedures for their experiment designed and complete Table 6.1 with three of their mistakes and corrections of these mistakes.

Student-written instructions to prepare sodium nitrate solution

1. Pipette 25.00cm^3 of aqueous sodium carbonate into a conical flask.
2. Add 2 to 3 drops methyl orange indicator to the flask.
3. Add in dilute hydrochloric acid using a measuring cylinder until the indicator changes colour. Record the volume of acid used.
4. Repeat steps 1 to 3 using the volume of acid recorded.

Table 6.1

students' mistake	corrections to mistake

[3]

(b) Use the following information to suggest the steps needed to prepare by precipitation pure barium sulfate, starting from barium hydroxide.

- barium sulfate is insoluble in water
- barium hydroxide is insoluble in water
- barium nitrate is soluble in water

.....

.....

.....

.....

..... [3]

(c) 32g of oxygen was used in the following reacton.
The reaction is represented by the following equation.

$$4PH_3(g) + 8O_2(g) \rightarrow P_4O_{10}(s) + 6H_2O(g)$$

(i) What is the mass of water vapour produced when 32g of oxygen reacted completely?

mass = ... g [2]

(ii) Calculate the volume of phosphine used in this reaction at room temperature and pressure.

volume = ... dm^3 [2]

7 Three students worked separately, each with 0.1mol/dm^3 of dilute hydrochloric acid, but with different metals, calcium, magnesium and copper.

Each student added 0.4mol of powdered metal to an excess of the acid in a conical flask connected to a gas syringe.

The students recorded the volume of gas collected at regular intervals over the next 400 seconds.

The result of the reaction of magnesium metal is plotted on the graph below in Fig. 7.1.

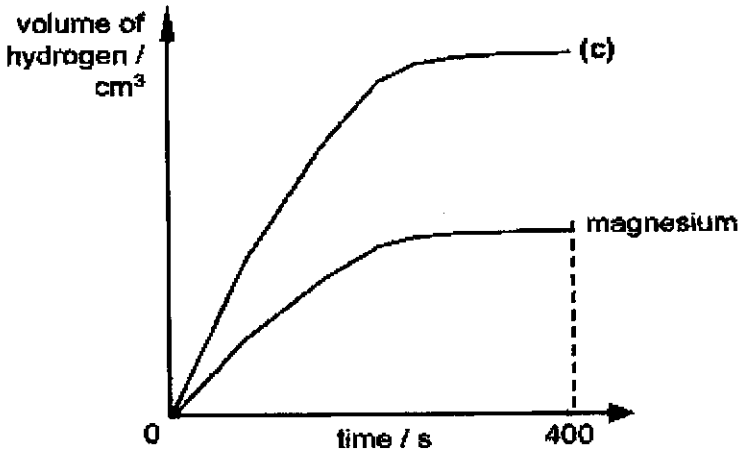


Fig. 7.1

(a) Add to Fig. 7.1 the graph you would expect for the reaction of copper and calcium metals. Label and explain your graphs clearly.

.....

.....

.....

..... [3]

(b) Describe how you would use the graph in Fig. 7.1 to determine the speed of reaction at 200 seconds.

.....

.....

..... [2]

(c) One of the students repeated the experiment between magnesium and 0.2mol/dm^3 of dilute hydrochloric acid and sketched the graph labelled **(c)** in Fig. 7.1.

(i) Using ideas on collision theory, explain how and why the speed of reaction changes.

.....

.....

..... [2]

(ii) Describe and explain the error in graph **(c)**.

.....

..... [1]

(d) Calcium also reacts with water readily to produce hydrogen gas.

(i) Write a chemical equation for the reaction between calcium and water.

..... [1]

(ii) Explain why hydrogen is formed in the reaction.

.....

..... [1]

8 Table 8.1 shows the composition of the atmosphere of the planet Mars.

gas	percentage composition / %
carbon dioxide	95.3
nitrogen	1.7
argon	1.6
oxygen	0.2
other gases	1.2

Table 8.1

(a) Describe how the gases in Table 8.1 can be separated.

.....

.....

.....

..... [2]

(b) How does the atmosphere on Mars differ from the atmosphere on Earth?

.....

.....

..... [2]

(c) Nitrogen dioxide is a pollutant gas on Earth. It is not found on Mars.

State the main source of nitrogen dioxide in the Earth's atmosphere and describe **one** harmful effect of it on the environment.

source.....

effect.....

..... [2]

(d) Volcanoes were found on Mars.

How will this affect the composition of the atmosphere on Mars?

..... [1]

(e) Carbon monoxide reacts with 6.4g of oxygen in the atmosphere to form carbon dioxide.

$$2CO + O_2 \rightarrow 2CO_2$$

Calculate the mass and volume of carbon dioxide produced from this reaction.

mass = ...g

volume =.....dm^3 [3]

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																2 He helium 4
	3 Li lithium 7	4 Be beryllium 9					1 H hydrogen 1				5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
	11 Na sodium 23	12 Mg magnesium 24									13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
	55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium -	85 At astatine -	86 Rn radon -
	87 Fr francium -	88 Ra radium -	89 – 103 actinoids	104 Rf Rutherfordium -	105 Db dubnium -	106 Sg seaborgium -	107 Bh bohrium -	108 Hs hassium -	109 Mt meitnerium -	110 Ds darmstadtium -	111 Rg roentgenium -	112 Cn copernicium -		114 Fl flerovium -		116 Lv livermorium -		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium -	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium -	95 Am americium -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

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

MARK SCHEME

1	B
2	D
3	A
4	D
5	B
6	A
7	B
8	D
9	A
10	B

11	C
12	A
13	A
14	A
15	D
16	A
17	D
18	C
19	D
20	C

21	B
22	B
23	C
24	B
25	C
26	C
27	B
28	B
29	C
30	A

31	C
32	A
33	D
34	A
35	C
36	B
37	B
38	B
39	C
40	C

MARK SCHEME

Section A [45 m]

1	**(a)** **Q** = ammonia [NH_3]; **S**: silver chloride [Ag*Cl*] **(b)** ammonium chloride / ammonium nitrate **(c)** Ag^+ (aq) + Cl^- (aq) → Ag*Cl* (s) / $NH_4^+ + OH^- \rightarrow NH_3 + H_2O$ **(d)** It is an endothermic reaction, where heat energy is absorbed from the surroundings, resulting in a decrease in temperature.	[2] [1] [2] [1]
2	**(a)** **X** = electrons; **Y** = protons; **Z** = neutrons **(b)** **X** = 17; **Y** = 17; **Z** = 18 **(c)** **(i)** The relative atomic mass of an element is the average mass of one atom of the element compared to $\frac{1}{12}$ the mass of a carbon-12 atom. **(ii)** There are more ^{35}Cl atoms than ^{37}Cl atoms. **(d)** **(i)** Choose any one: • Both exist as diatomic molecules / coloured elements. • Both atoms have seven valence electrons. **(ii)** Choose any one: • Chlorine molecules are far apart in a randomly arrangement, while bromine molecules are closely packed in a disorderly arrangement. • Chlorine molecules are free to move, while bromine molecules slide over each other.	[2] [1] [2] [1] [1] [1]
3	**(a)** sodium; E.C. = 2.8.1 Sodium is in Group I as its atom has 1 valence electron. Sodium is in Period 3 as its atom occupies 3 electron shells. **(b)** The atom already has a stable electronic configuration, so it does not need to lose, gain or share electrons to achieve stability. **(c)** **(i)** Dot-and-cross diagram of sodium oxide $2[Na]^+ [O]^{2-}$ (ionic) Dot-and-cross diagram of dichlorine monoxide C*l*-O-C*l* covalent) **(ii)** Sodium oxide exists as an ionic compound. A large amount of heat energy is required to overcome the strong electrostatic forces of attraction between the **ions**. Dichlorine monoxide exists as a simple covalent molecule. A small amount of heat energy is required to overcome the weak intermolecular forces of attraction between **molecules**. **(d)** **(i)** Al_2O_3 / aluminium oxide **(ii)** SO_2 / sulfur dioxide **(iii)** The limestone decomposes to produce calcium oxide and carbon dioxide. $CaCO_3 \rightarrow CaO + CO_2$ The basic calcium oxide reacts with the acidic impurity, SiO_2, to produce slag. $CaO + SiO_2 \rightarrow CaSiO_3$	[1] [1] [1] [2] [2] [1] [1] [1] [1] [1] [1] [1]

4	**(a)** Choose any <u>two</u>: • The metals have a <u>high melting and boiling point</u>. • The metals have a <u>high density</u>. • The metals are <u>good conductors of heat and electricity</u>. **(b)** **(i)** An **alloy** is a <u>mixture</u> of a <u>metal</u> with <u>another element</u>. **(ii)** The presence of <u>atoms</u> of a <u>different size</u> in mag-thor <u>disrupts the orderly arrangement</u> of atoms, causing the layers of atoms to be <u>unable to slide over each other</u> easily. Hence, mag-thor is much <u>harder</u> than pure magnesium. **(iii)** Choose any <u>two</u>: • Recycling conserves earth's ores / metals, as metals are a <u>finite</u> natural resource. • Recycling <u>saves energy / money</u>, as extraction of metals from the ore consumes energy (e.g. heating in hot blast furnace) and is expensive (e.g. electrolysis). • Recycling <u>limits pollution</u>, as extraction of metal from the ore may release harmful gases (e.g. carbon monoxide and carbon dioxide, etc.) into the atmosphere. **(iv)** **<u>A</u>**; **<u>E</u>**; **<u>C</u>**; **<u>B</u>** **(c)** Magnesium, being <u>less reactive</u> than calcium, is <u>unable to displace</u> calcium from its oxide. Calcium, however, being <u>more reactive</u> than magnesium, is <u>able to displace</u> magnesium from its oxide.	[2] [1] [1] [1] [2] [1] [1]
5	**(a)** **(i)** <u>Fe_2O_3 = +3</u>; <u>Fe = 0</u> **(ii)** <u>Extraction</u> involves <u>reduction</u> as the oxidation state of iron decreases from +3 in Fe2O3 to 0 in Fe. <u>Rusting</u> involves <u>oxidation</u> as the oxidation state of iron increases from 0 in Fe to +3 in Fe_2O_3. **(b)** The oil, the paint and plastic coating slow down rusting by the <u>surface barrier protection</u> method, which prevents <u>oxygen</u> and <u>water</u> from coming into <u>contact</u> with iron.	[1] [1] [1] [1] [1]

Section B [20 m]

6 **(a)** Choose any three: [3]

students' mistake	corrections to mistake
pipette 25.00cm^3	pipette 25.0cm^3
measuring cylinder	burette
dilute hydrochloric acid	dilute nitric acid
repeat steps 1 to 3 using the volume of acid recorded	repeat steps 1 to 3 using the volume of acid recorded, without the use of indicator

(b) 1. Add excess barium hydroxide to warm dilute nitric acid. [1]
2. Filter the mixture to obtain barium nitrate as the filtrate.
3. Mix dilute sulfuric acid / aqueous sodium sulfate with aqueous barium nitrate. [1]
4. Filter the mixture to obtain barium sulfate as the residue.
5. Wash the residue with distilled water. [1]
6. Dry the residue by pressing between two pieces of filter papers.

(c) **(i)** $4PH_3(g) + 8O_2(g) \rightarrow P_4O_{10}(s) + 6H_2O(g)$

Fr. Eqn.:	8	6
Given :	32g	?g
M_r :	32	18
	1mol	0.75mol

[1]

mass of water vapour = 0.75mol x 18 = 13.5g [1]

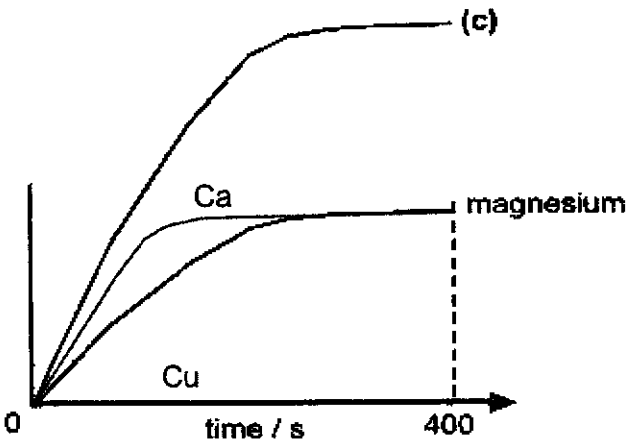
(ii) $4PH_3(g) + 8O_2(g) \rightarrow P_4O_{10}(s) + 6H_2O(g)$

Fr. Eqn.:	4	8
Given :	?dm^3	32g
M_r :		32
	0.5mol	1mol

[1]

volume of phosphine = 0. 5mol x 24dm^3 = 12dm^3 [1]

7 **(a)**



[1]

Copper is unreactive. [1]
The volume remains at 0cm^3 since it does not react with acid.
Calcium is more reactive than magnesium. [1]
The gradient is steeper as the speed of reaction is faster.

	(b) Draw a tangent at 200 seconds. Calculate the gradient of this tangent to determine the speed of reaction at 200 seconds. **(c)** **(i)** A higher concentration of dilute hydrochloric acid increases the number of reactant particles in a given volume, leading to more effective collisions between the particles, resulting in a higher speed of reaction. **(ii)** The volume of hydrogen obtained should be the same as the other experiment, as acid is in excess. **(d)** **(i)** $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ **(ii)** Calcium, being more reactive than hydrogen, is able to displace hydrogen from water.	[1] [1] [1] [1] [1] [1] [1]
8	**(a)** Fractional distillation of liquefied air. The components of liquefied air are separated based on their different boiling points. The liquid with the lowest boiling point will be distilled first, while the one with the highest boiling point will be distilled last. **(b)** Choose any two: • On Mars, carbon dioxide is most abundant at 95.3%, unlike on Earth where there is only 0.03%. • On Earth, nitrogen is most abundant at 78%, unlike on Mars where there is only 1.7%. • On Earth, there is 21% oxygen, but there is only 0.2% oxygen on Mars. **(c)** source : combustion of fuel in cars at high temperature OR : lightning activity effect : [health] It causes irritation to eyes and breathing difficulties; it corrodes the body's internal irgans. : [environment] It causes the formation of acid rain, which results in the corrosion of limestone buildings / metal structures. **(d)** There will be sulfur dioxide present on Mars. **(e)** $2CO + O_2 \rightarrow 2CO_2$ Fr. Eqn.: 1 2 Given : 6.4g ?g M_r : 32 44 0.2mol 0.4mol mass of carbon dioxide = 0.4mol x 44 = 17.6g volume of carbon dioxide = 0.4mol x 24dm^3 = 9.6dm^3	[1] [1] [2] [1] [1] [1] [1] [1] [1]

Name: ..... ( ) Class: Sec 4/5.....

Queenstown Secondary School

Preliminary Examination 2021
Secondary Four Express / Five Normal (Academic)
Science (Physics, Chemistry)
5076/01

1 September 2021
Wednesday

Time: 1000 – 1100h
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.

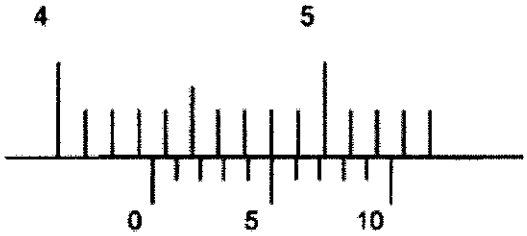
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 Data Sheet is printed on page 16.
A copy of the Periodic Table is printed on page 17
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **17** printed pages.

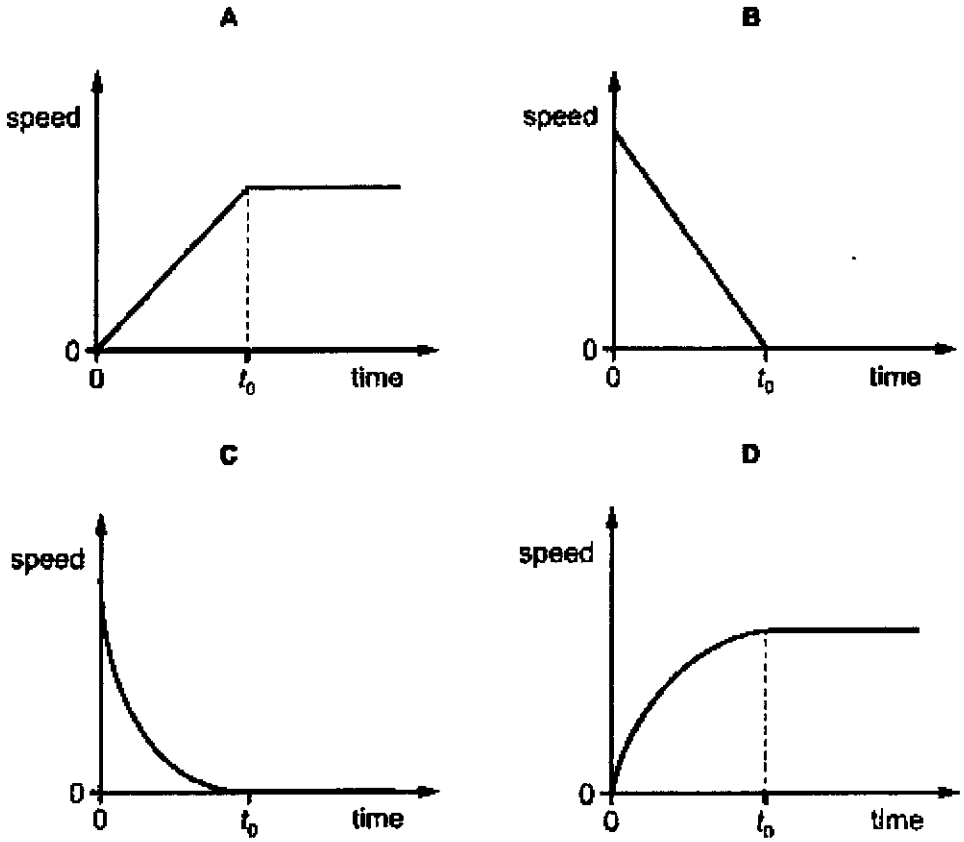
1 A student uses the vernier calipers to measure the diameter of a coin.
The reading on the scale is shown below.



What is the diameter of the coin?

A 4.25 cm **B** 4.35 cm **C** 4.38 cm **D** 4.80 cm

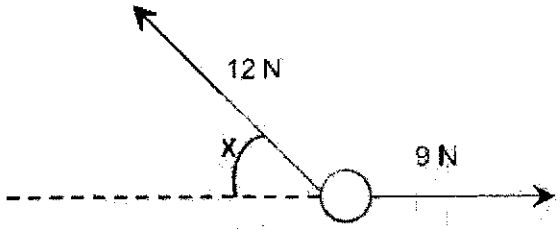
2 A sky diver jumps off a plane and falls through the sky until he reaches constant speed.
Which graph below shows how his speed changes with time until he reaches constant speed?



3 A deep-sea diver is sinking into deep water at a constant speed of 0.5 m/s.
What is the resultant force acting on the diver if he, together with his diving gear, has a total mass of 100 kg?

A 0 N
B 100 N downwards
C 1000 N downwards
D 1000 N upwards

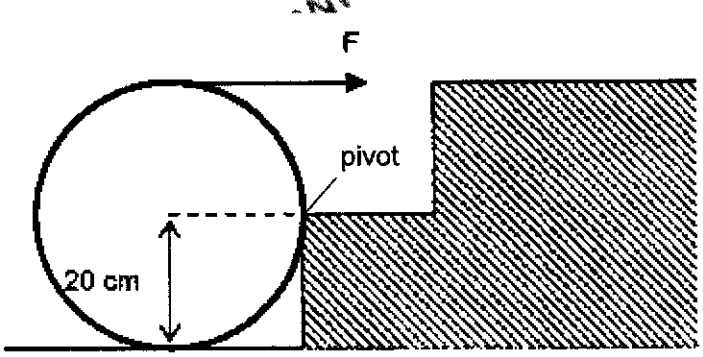
4 The diagram below shows two forces acting on a ball at the same time.
The angle x between the 12 N and 9 N force can vary between 0° and 180°.



Which of the following **cannot** be a possible resultant force on the ball?

A 3.25 N **B** 9 N **C** 21 N **D** 30 N

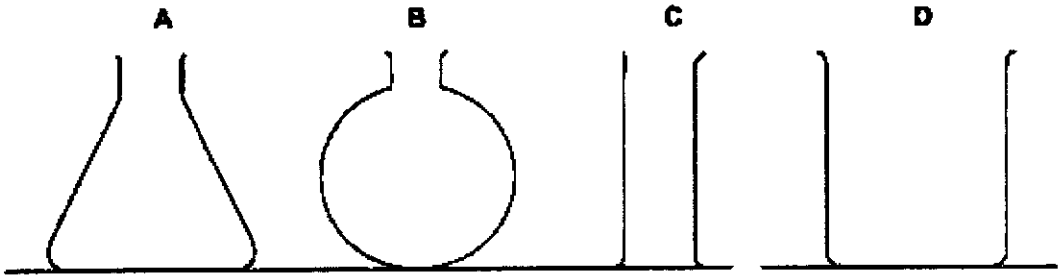
5 The diagram shows a ball of radius 20 cm placed against a step.



If the ball weighs 40 N, what is the minimum force F that can be applied to move the ball up the step?

A 20 N **B** 40 N **C** 800 N **D** 1600 N

6 Which container below is the most stable?



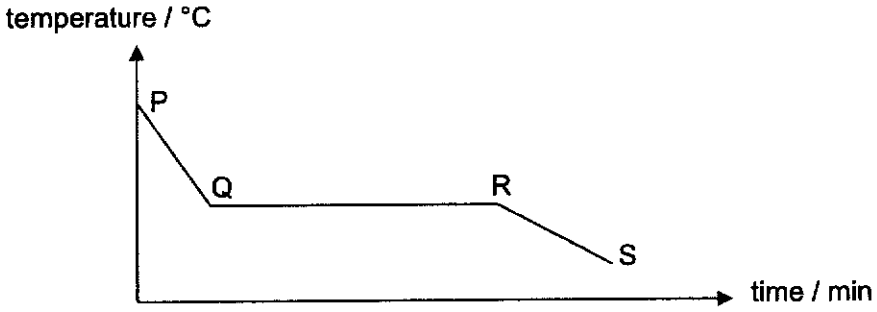
7 A 5 N force is exerted on an object R along a rough surface with a friction of 2 N.
What is the work done to move object R for 10 m on the rough surface?

A 20 J **B** 30 J **C** 50 J **D** 70 J

8 A cold solid is placed on top of a hot solid. The thermal energy flows from the hot solid to the cold one.
Which is the explanation for this?

A Hot particles rises while cool particles sink.
B The particles are free to move randomly through the solids.
C The hot solid expands so its particles will move further apart.
D Thermal energy is passed from one particle to the next through vibrations.

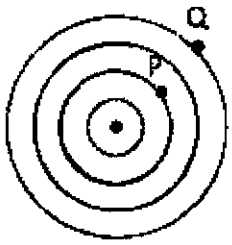
9 Some wax in a test tube was heated till it melted. It was then allowed to cool. The temperature time graph during the cooling process is shown.



Which statement is correct?

A Along PQ, the molecules lose kinetic energy.
B Along QR, the molecules gain potential energy.
C Along QR, the molecules gain kinetic energy.
D Along RS, the molecules lose potential energy.

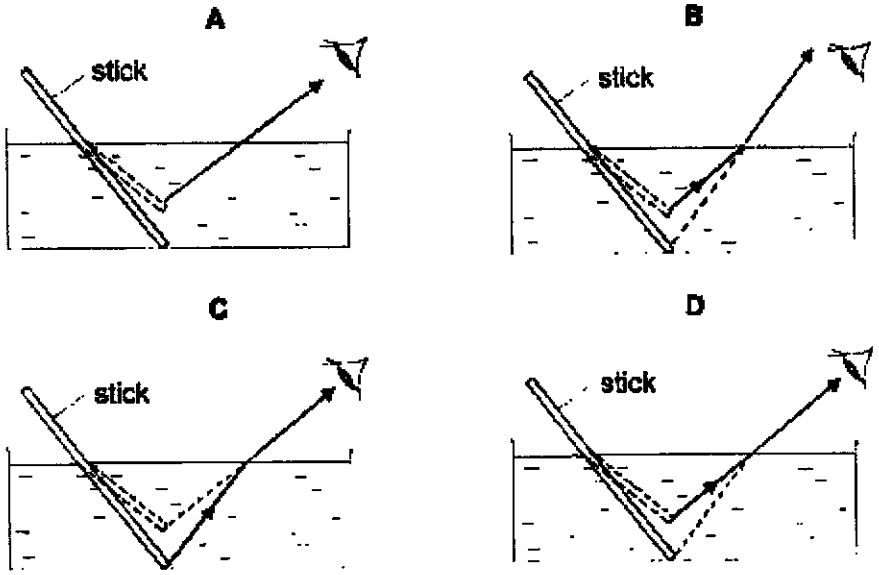
10 Circular water waves are produced by a dot vibrator at a frequency of 4.0 Hz.
The wave pattern at a certain instant is as shown in the diagram below.



If the speed of the water waves is 0.6 m/s, what is the distance travelled by the wave from point P to point Q?

A 0.15 m **B** 0.30 m **C** 6.67 m **D** 13.3 m

11 Which of the following diagram show the correct ray diagram of how the submerged portion of the stick is seen in the water?



12 The converging lens in a camera is used to make an image on a film.
At which point could an object be placed so that it forms a diminished image?

13 Human body can give off electromagnetic radiation.

Which electromagnetic radiation is emitted by the human body?

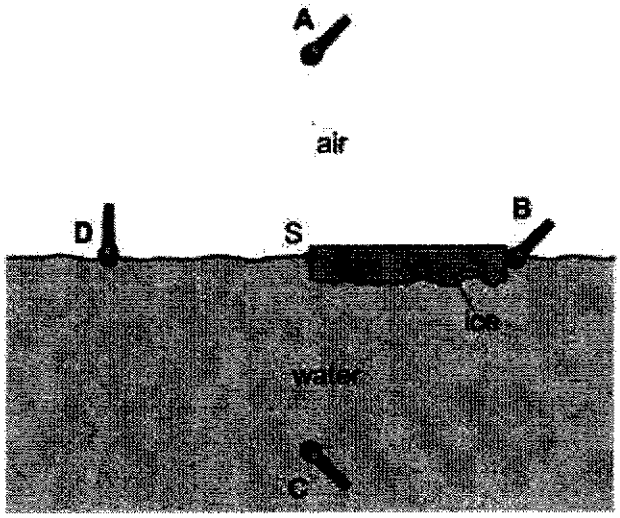
A infrared **B** ultraviolet **C** visible light **D** X-rays

14 A sheet of ice floats on water.

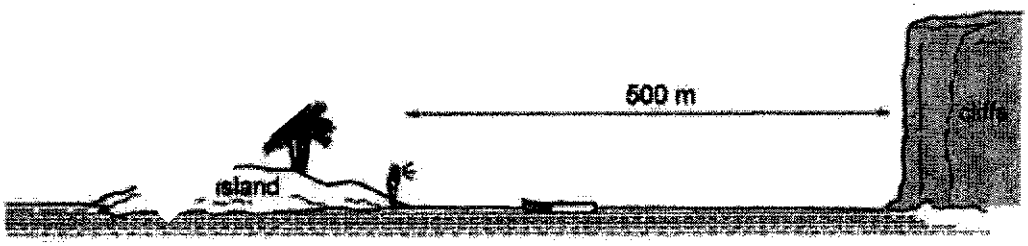
A source of sound is placed as position S at the edge of the ice sheet.

Four microphones are placed at equal distances from S.

Which microphone detects the sound from S **last**?



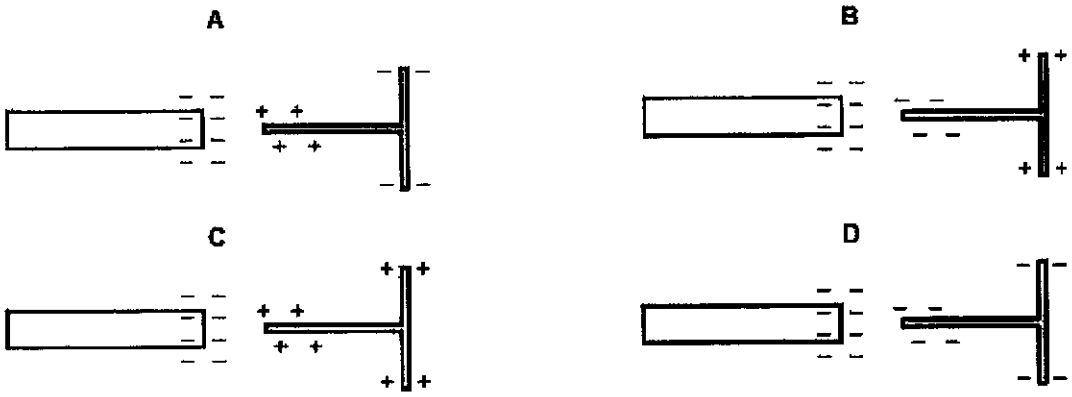
15 A boy is stranded on an island. He shouts for help and hears the echo of his shout from some cliffs that are 500 m away.



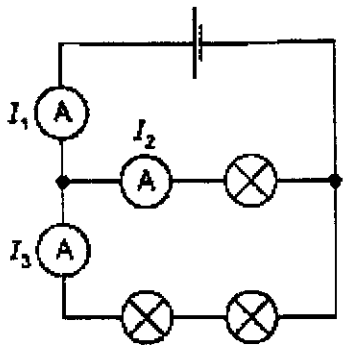
Given that sound travels at 300 m/s through air, what is the time interval between the boy shouting and hearing the echo?

A 0.60 s **B** 1.20 s **C** 1.67 s **D** 3.33 s

16 A negatively-charged rod is brought close to an isolated T-shaped piece of metal.
The metal is uncharged initially.
Which diagram shows the correct charge distribution on the metal after a while?



17 Three identical lamps and three identical ammeters are connected as shown.



The readings on the ammeters are I_1, I_2 and I_3.
How are the readings related?

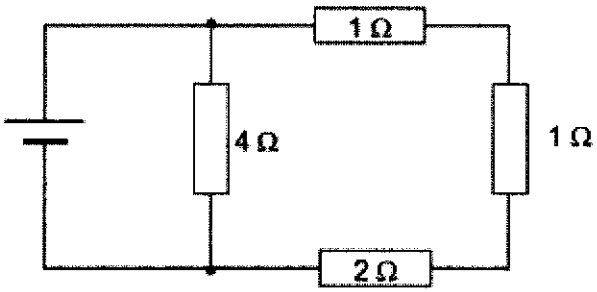
A $I_1 = I_2 = I_3$

B $I_1 > I_2$ and $I_2 = I_3$

C $I_1 > I_3 > I_2$

D $I_1 > I_2 > I_3$

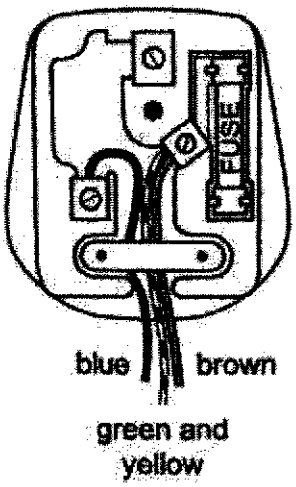
18 The diagram shows four resistors connected to a dry cell.



What is the effective resistance of the circuit?

A 0.364 Ω **B** 0.500 Ω **C** 2.00 Ω **D** 8.00 Ω

19 The internal wiring of a plug is shown below.



What is the effect of using the plug wired this way?

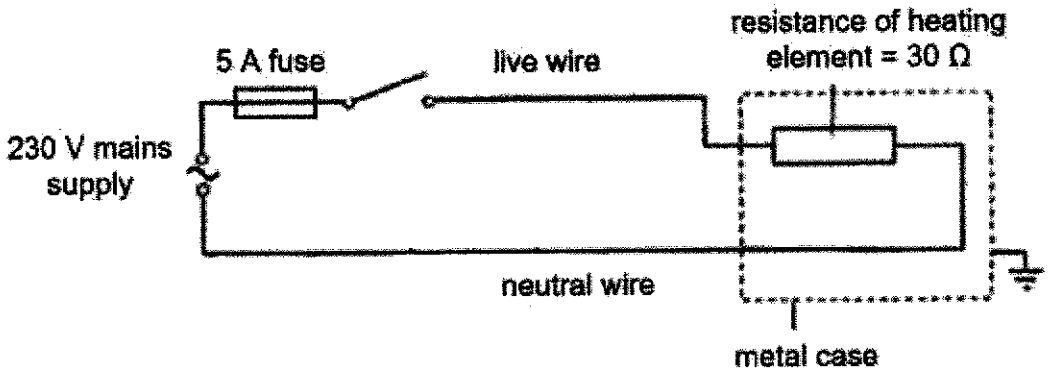
A The appliance will not work.

B The appliance will catch fire.

C The fuse in the plug will blow.

D The metal casing of the appliance will become live.

20 The diagram below shows the circuit of a kettle that is plugged into a mains socket.



What is the fault in the circuit?

A The position of the earth wire should be higher.

B The fuse should be placed on the neutral wire.

C The fuse rating is too low, which will cause the fuse to blow.

D The kettle is still connected to the high voltage terminal even when the switch is open.

21 50cm³ of aqueous sodium thiosulfate reacts with 50cm³ dilute hydrochloric acid as shown in the equation below. measuring cylinder

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

Sulfur dioxide is soluble in water and is denser than air. downward delivery

A student wants to collect the sulfur dioxide gas and sulfur precipitate produced. filter funnel and paper

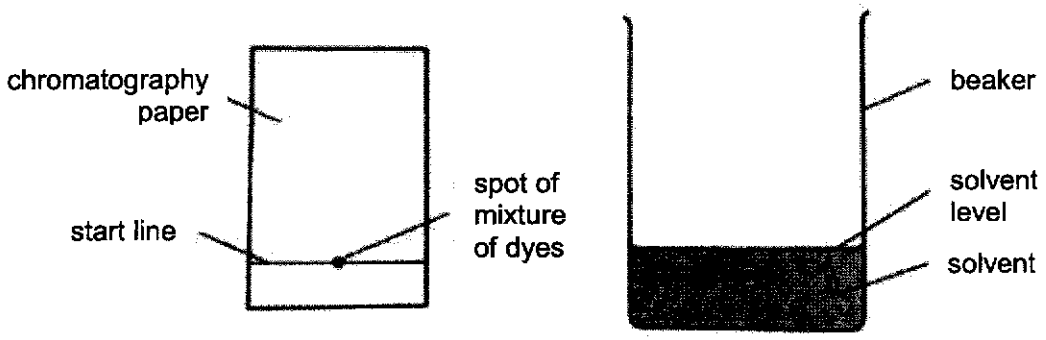
Which gas collection method can be used to collect sulfur dioxide and which apparatus(s) are required for the experiment?

	gas collection method	apparatus(s)
A	displacement of water	filter funnel and paper
B	**downward delivery**	**measuring cylinder, filter funnel and paper**
C	upward delivery	burette, filter funnel and paper
D	displacement of water	mass balance, filter funnel and paper

22 An experiment is carried out to separate a mixture of two dyes.

A line is drawn on a piece of chromatography paper and a spot of the mixture of dyes is placed on it.

The paper is dipped into a solvent and left for several minutes.



Which statement about this experiment is correct?

A The dyes must have [redacted].

B **The start line on the paper must be drawn in pencil.**

C The dyes must have the [redacted] in the solvent.

D The paper must be placed with the start line [redacted] the level of the solvent.

*** [above]**

23 Three bottles containing colourless solutions have no labels.

A series of individual tests are carried out on each of the solutions.

Which bottle contains ammonium sulfate solution?

	test 1: add warm sodium hydroxide [redacted]	test 2: add dilute nitric acid and aqueous barium nitrate [redacted]	test 3: add dilute hydrochloric acid
A	gas produced turns damp red litmus paper blue	effervescence observed	effervescence observed
B	no visible change	effervescence observed	no visible change
C	**gas produced turns damp red litmus paper blue**	**white precipitate forms**	**no visible change**
D	no visible change	white precipitate forms	effervescence observed

24 The following substances are present on the surface and/or in the atmosphere of Covidium, a newly found planet.

substance	melting point / °C	boiling point / °C
argon	-189	-116
nitrogen	-210	-196
hydrogen	-259	-252

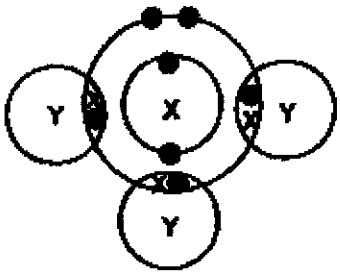
Which of the substance(s) would exist as particles that are closely packed in an orderly manner at -250°C? [solid]

A argon only
B **argon and nitrogen only**
C argon and hydrogen only
D nitrogen and hydrogen only

25 Which of the following statements about atoms and ions is correct?

A The nucleon number of an element is the number of [redacted]. * **[and protons]**
B The number of [redacted] and electrons are the same in an atom. * **[protons]**
C **An atom with atomic number of 5 will lose 3 electrons to form a positive ion.**
D Protons have a positive charge while electrons are [redacted]. * **[negative]**

26 The diagram shows the arrangement of electrons of a compound XY_3.



Which statement is **incorrect** about the compound XY_3? [covalent bonding]

A X atom shares 3 valence electrons with three Y atoms.
B The compound cannot conduct electricity in any physical state.
C **Y atom [redacted] an electron from X atom.** * **[shares]**
D 3 pairs of valence electrons are involved in the bonding of this compound.

27 A nitrate of iron has the formula $Fe(NO_3)_2$.

What is the charge of the iron ion?

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

28 $20cm^3$ of methane, CH_4, are reacted with $30cm^3$ of oxygen.

The equation for the reaction is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

All volumes are measured at r.t.p.

What is the total volume of gas remaining at the end of the reaction?

A $15cm^3$ **B** $\underline{20cm^3}$ **C** $45cm^3$ **D** $50cm^3$

	$CH_4(g)$	+	$2O_2(g)$	→	$CO_2(g) + 2H_2O(l)$
Fr. Eqn.:	1		2		1
Given :	$15cm^3$		$30cm^3$		$?cm^3$
	$\underline{5cm^3 \text{ left}}$		$0cm^3$ left		$\underline{15cm^3 \text{ formed}}$
	(excess)		**(limiting)**		

29 0.6g of magnesium reacted with $100cm^3$ of an unknown concentration of dilute hydrochloric acid.

The equation for this reaction is shown.

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

What is the concentration of the dilute hydrochloric acid?

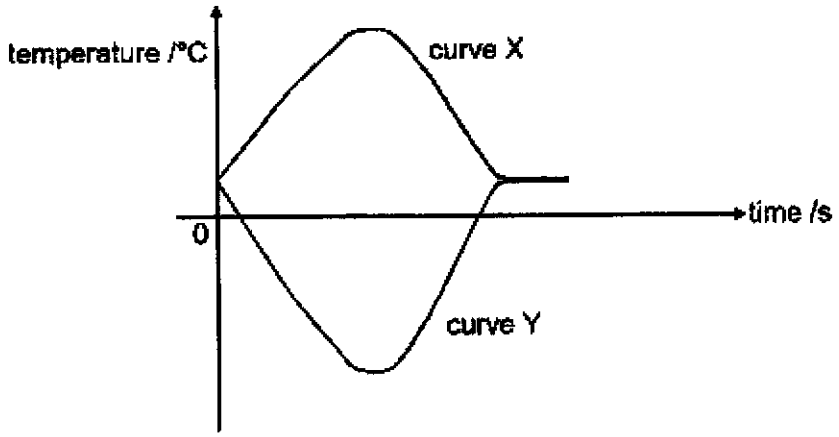
A $0.0005mol/dm^3$ **B** $0.25mol/dm^3$ **C** $\underline{0.5mol/dm^3}$ **D** $1mol/dm^3$

	Mg	+	$2HCl \rightarrow MgCl_2 + H_2$
Fr. Eqn.:	1		2
Given :	0.6g		$?mol/dm^3$
			$0.1dm^3$
	0.025mol		0.05mol

molar concentration of HCl = 0.05 mol ÷ $0.1dm^3$ = $\underline{0.5mol/dm^3}$

30 The temperature of a reaction between aqueous sodium hydroxide and dilute sulfuric acid was monitored as the reaction proceeds. [redacted]

Which of the statement shows the results obtained from the experiment?



A **Curve X is correct as the reaction is exothermic.**

B Curve Y is correct as the reaction is exothermic.

C Curve X is correct as the reaction is endothermic.

D Curve Y is correct as the reaction is endothermic.

31 100cm^3 of 0.1mol/dm^3 hydrochloric acid **[aqueous]** were added to a 2g sample of calcium carbonate **[solid]**. [redacted]

Which of the following changes would increase the initial rate of the reaction without increasing the volume of carbon dioxide formed?

I the addition of 5cm^3 of 2mol/dm^3 hydrochloric acid to the original acid ✗

II raising the temperature ✓

III the use of more finely divided calcium carbonate ✓

A I and II only **B** I and III only **C** **II and III only** **D** all of the above

32 The equation for the extraction of iron from haematite is as shown below.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$ [redacted]

Which statement accurately explains the process?

A **CO is a reducing agent as it is oxidised to form CO_2 with the gain of oxygen.**

B CO is an oxidising agent as it is reduced to form CO_2 with the gain of oxygen.

C Fe_2O_3 is a reducing agent as it is reduced to form Fe with the loss of oxygen.

D Fe_2O_3 is an oxidising agent as it is oxidised to form Fe with the loss of oxygen.

33 Which statement about acids and bases is correct?

A Acids react with [redacted] metals to form salt and hydrogen. * **[Cu, Ag, Au]**

B Acids turns damp red litmus paper [redacted]. * **[red]**

C Alkalis dissolve in water to form hydroxide ions and their pH is [redacted] than 7. * **[more]**

D **Alkalis react with ammonium salt to give salt, water and ammonia.**

34 Which ionic equation represents the neutralisation of dilute hydrochloric acid and aqueous sodium hydroxide?

A **$H^+ + OH^- \rightarrow H_2O$**

B $Na^+ + Cl^- \rightarrow NaCl$

C $H^+ + Cl^- \rightarrow HCl$

D $H^+ + O^{2-} \rightarrow H_2O$

35 The oxide of an element X was added to dilute nitric acid and aqueous potassium hydroxide separately.

The word equation for the reactions are shown below.

X oxide + dilute nitric acid → no reaction [redacted]

X oxide + aqueous potassium hydroxide → salt + water [redacted]

Which row describes X and its oxide?

	X	X oxide
A	non-metal	basic
B	metal	acidic
C	**non-metal**	**acidic**
D	metal	amphoteric

36 Which method is used to prepare silver nitrate? [redacted]

A adding [redacted] to dilute nitric acid at room temperature * **[unreactive]**

B **adding excess silver oxide to warm dilute nitric acid**

C [redacted] silver hydroxide with dilute nitric acid * **[soluble SPA]**

D [redacted] the salt by adding silver chloride to sodium nitrate solution * **[insoluble]**

37 Which of the following statements about the elements in the Periodic Table are correct?

I The melting points decrease from Li to Cs for alkali metals. ✓

II The number of electron shells does not increase across a period. ✓

III Reactivity [redacted] from He to Xe for the noble gases. * **[unreactive]**

IV Halogens exist as diatomic molecules. ✓

V Alkali metals have [redacted] density and are soft metals. * **[low]**

A I and II only **B** **I, II and IV only**

C I, III and IV only **D** II, IV and V only

38 Which row shows the properties of the element chlorine?

$C\mathit{l}_2(g) + 2KBr(aq) \rightarrow 2KC\mathit{l}(aq) + Br_2(\mathit{l})$

colourless **red-brown**

	colour	physical state at room temperature	effect of potassium bromide solution
A	pale yellow	gas	turns red-brown
B	**green-yellow**	**gas**	**turns red-brown**
C	red-brown	liquid	remains colourless
D	black	solid	remains colourless

39 Aluminium is an important metal to mankind.

It is used in storing food items because of its properties. [unreactive]

Which of the following best explains why aluminium metal is used?

A Aluminium extraction requires electrolysis.

B Aluminum is easily recycled.

C **Aluminium has a layer of protective oxide.**

D Aluminium is a finite resource.

40 Which statements about carbon monoxide are correct?

1 It is produced from the [redacted] burning of natural gas. * **[incomplete]**

2 It reacts with haemoglobin in the blood. ✓

3 It causes [redacted] which corrodes limestone buildings. * **[neutral]**

4 It is a colourless, odourless gas. ✓

A 1 and 2 only

B 1, 2 and 3 only

C **2 and 4 only**

D 1 and 3 only

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

Key

proton (atomic) number **atomic symbol** name relative atomic mass

I	II	Group										III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

MARK SCHEME

1	B
2	D
3	A
4	D
5	B
6	A
7	B
8	D
9	A
10	B

11	C
12	A
13	A
14	A
15	D
16	A
17	D
18	C
19	D
20	C

21	B
22	B
23	C
24	B
25	C
26	C
27	B
28	B
29	C
30	A

31	C
32	A
33	D
34	A
35	C
36	B
37	B
38	B
39	C
40	C