

Class	Register Number	Name
-------	-----------------	------



南洋女子中學校
NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2019
Secondary Three

Chemistry

Paper 1

Multiple Choice

Monday

14 October 2019

45 minutes

0845-0930

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number on the Multiple Choice Answer Sheet provided.

There are **thirty** questions in 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 Multiple Choice Answer Sheet.

INFORMATION FOR CANDIDATES

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.

The use of approved scientific calculators is allowed.

A copy of the Periodic Table is found on page 14.

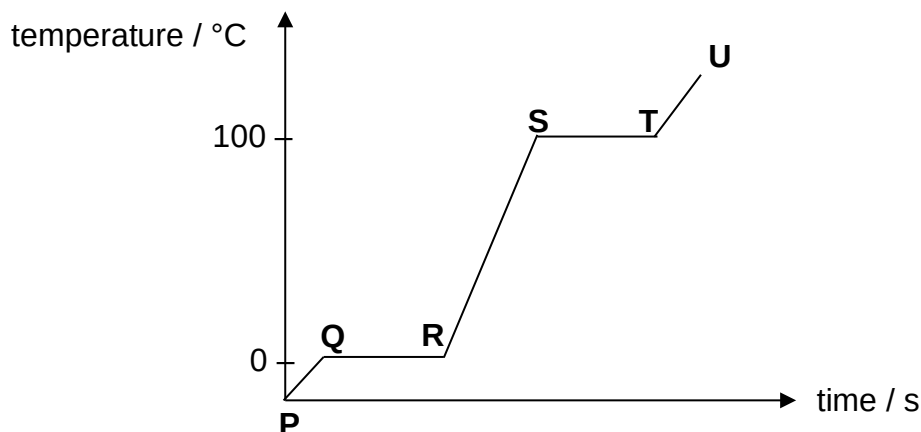
This document consists of 14 printed pages.

Setter: FKD

NANYANG GIRLS' HIGH SCHOOL

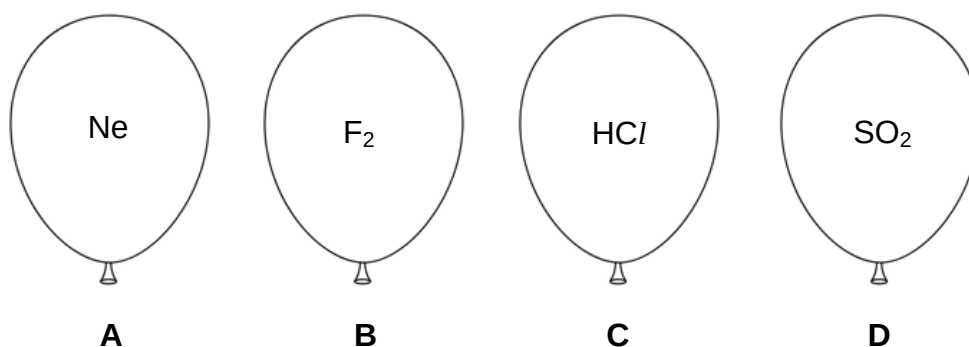
[Turn over]

- 1 The graph shows the change in temperature with time when ice is heated.

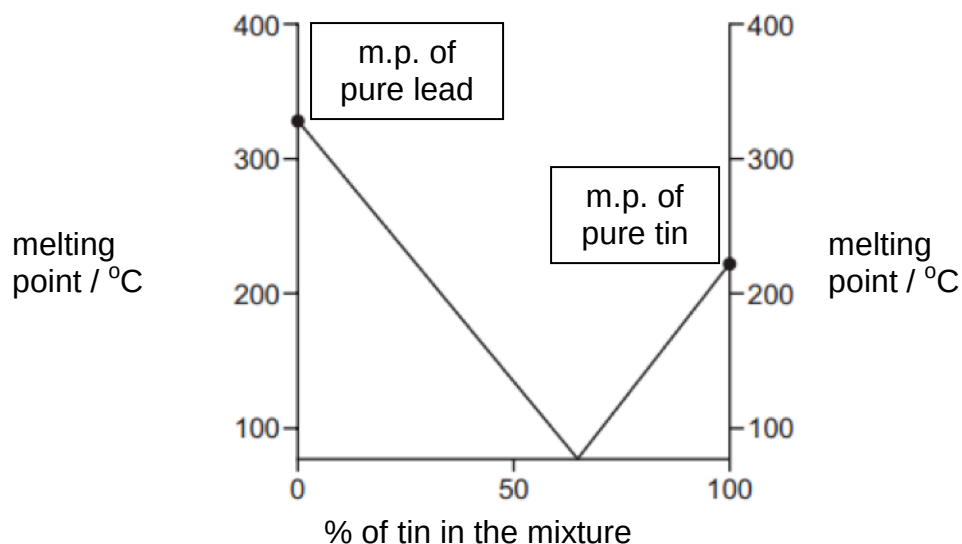


At which region can you find a mixture of ice and water?

- A P to Q
B Q to R
C R to S
D S to T
- 2 Four balloons are inflated with equal volumes of different gases and left in a room. Which balloon is most likely to deflate the fastest?

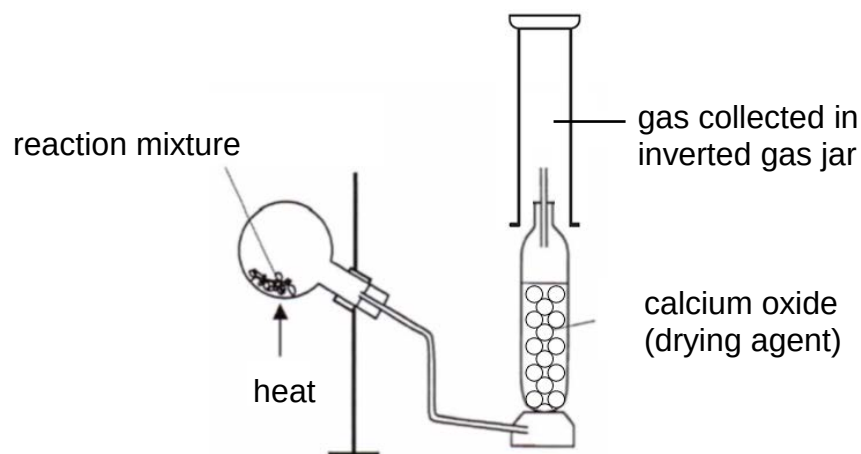


- 3** The graph gives the melting points (m.p.) of mixtures of lead and tin.



What would be the melting range of a mixture of lead and tin?

- A** Above the melting point of tin.
 - B** Below the melting point of lead.
 - C** Between the melting point of tin and lead.
 - D** Below the melting point of both tin and lead.
- 4** A student set up the apparatus as shown below.



What is the identity of the gas that was collected?

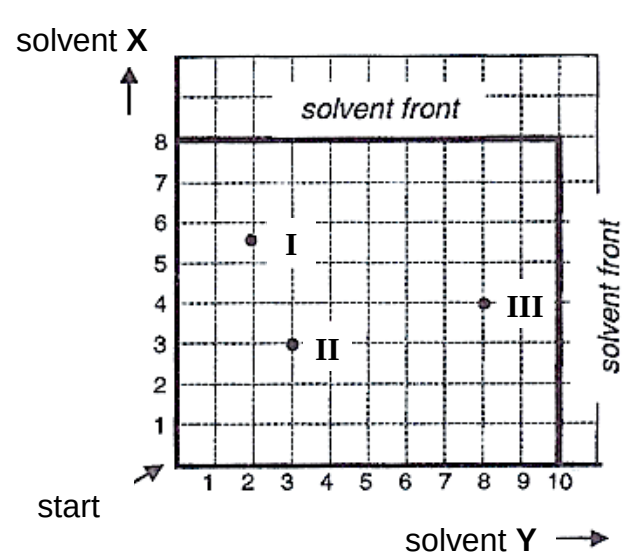
- A** ammonia
- B** carbon dioxide
- C** chlorine
- D** oxygen

- 5 Some physical properties of two substances **X** and **Y** are shown below.

substance	melting point (°C)	boiling point (°C)	solubility in water
X	−96.7	39.6	insoluble
Y	−114.5	78.5	soluble

Based on the information above, which of the following shows the best method of separating a mixture of **X** and **Y** in a school laboratory?

- A** evaporation to dryness
B filtration
C simple distillation
D using a separating funnel
- 6 A mixture of three amino acids is separated by two-way chromatography. The positions of three unknown amino acids **I**, **II** and **III**, after treating with a locating agent, are indicated in the chromatogram below.



amino acid	R_f value in solvent X	R_f value in solvent Y
glutamic acid	0.38	0.30
glycine	0.50	0.26
arginine	0.69	0.20
leucine	0.91	0.73

Using the information from the graph and the table above, which of the amino acids can be identified?

- A** **I** only
B **I** and **II**
C **II** and **III**
D **III** only

- 7 Which statement about some air pollutants is **incorrect**?
- A Sulfur dioxide produced by volcanic activity causes erosion of limestone buildings.
 - B Nitrogen emitted by internal combustion in car engines reacts with oxygen to form oxides of nitrogen.
 - C Carbon monoxide produced from incomplete combustion of petrol can be removed by catalytic converters.
 - D Ozone produced due to photochemical reactions increases the chance of skin cancer.
- 8 Which of the following processes remove carbon dioxide from the atmosphere?
- A combustion
 - B flue gas desulfurisation
 - C photosynthesis
 - D respiration
- 9 Two indicators, Bromophenol blue and Congo red, show the following colours in acidic solutions and in alkaline solutions.

indicator	colour in acidic solution	colour in alkaline solution
bromophenol blue	yellow	blue
congo red	violet	red

A few drops of each indicator are added to separate samples of dilute nitric acid. Subsequently, aqueous sodium hydroxide was added in excess to each of the samples.

What were the colour changes shown by the respective indicators?

	bromophenol blue	congo red
A	blue to yellow	violet to red
B	blue to yellow	red to violet
C	yellow to blue	red to violet
D	yellow to blue	violet to red

- 10** A student left a saturated solution of copper(II) sulfate to cool from 80°C to room temperature over three days. She observed that crystals separated out from the solution.

The following statements were made about crystallisation:

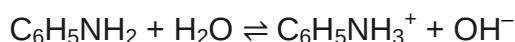
- I** The concentration of the solution remains the same.
- II** The mass of the dissolved copper(II) sulfate in the solution changes.
- III** The solubility of copper(II) sulfate decreases as the temperature falls.

Which statement(s) is/are correct?

- A** I only
 - B** II only
 - C** II and III
 - D** I, II and III
- 11** An acid ionizes in water to form X^{n-} . Aqueous potassium hydroxide with a concentration double that of the acid is used for complete neutralization. The ratio of the volume of acid to the volume of alkali is 2:3.

What is the value of n?

- A** 1
 - B** 2
 - C** 3
 - D** 4
- 12** Aniline, $C_6H_5NH_2$, appears as a yellowish to brownish oily liquid with a musty fishy odour. It undergoes the following reaction in water.



The following statements were made about aniline:

- I** It turns litmus paper red.
- II** It forms a blue precipitate with copper(II) sulfate.
- III** It reacts with sulfuric acid to form the salt $C_6H_5NH_3SO_4$.

Which statement(s) is/are correct?

- A** II only
- B** III only
- C** I and II
- D** II and III

- 13** Aluminium sulfate is sometimes used in water treatment to remove impurities. A test was conducted on four different samples of treated water and the table below shows the results of tests.

Which sample contains aluminium sulfate?

sample	reaction with excess NaOH (aq)	reaction with excess BaCl ₂ (aq)
A	colourless solution	white precipitate
B	white precipitate	colourless solution
C	white precipitate	white precipitate
D	colourless solution	colourless solution

- 14** A solid **X** was added to a colourless solution **Y**. There was no observable change.

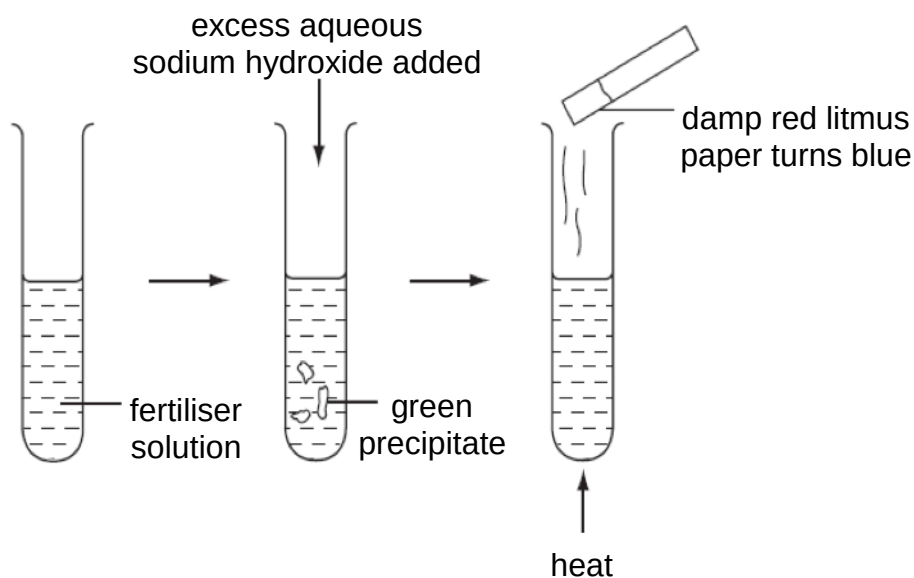
Which of the following could **not** be **X** and **Y**?

	solid X	solution Y
A	copper	sulfuric acid
B	magnesium	sodium carbonate
C	copper(II) carbonate	acetic acid
D	silver chloride	barium nitrate

- 15** Which of the following solutions can be used to distinguish between aqueous sodium hydroxide and aqueous ammonia?

- A** ammonium chloride
- B** copper(II) sulfate
- C** iron(III) chloride
- D** zinc sulfate

- 16** A solution of fertiliser was tested as shown below.



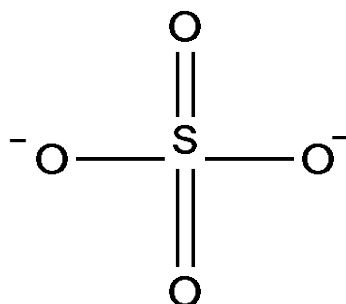
Which ions must be present in the fertiliser?

- A** Fe^{2+} and NH_4^+
 - B** Fe^{3+} and NH_4^+
 - C** Fe^{2+} and NO_3^-
 - D** Fe^{3+} and NO_3^-
- 17** The bond strength of a covalent bond is loosely associated with the size of the atoms. Generally, smaller atoms form stronger covalent bonds.

Which of the following combinations are arranged correctly according to their bond strengths in increasing order?

- A** $\text{H-Cl} < \text{H-Br} < \text{H-I}$
- B** $\text{H-F} < \text{H-O} < \text{H-N}$
- C** $\text{H-N} < \text{H-O} < \text{H-F}$
- D** $\text{H-Cl} < \text{H-I} < \text{H-Br}$

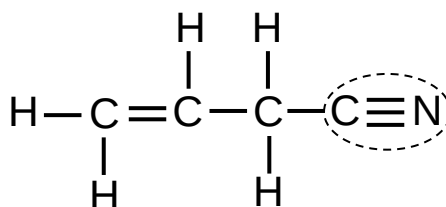
18 The structure of sulfate ion, SO_4^{2-} , is shown below.



Which of the following is true about the bonding and structure of sulfate ion?

- A The ion has a tetrahedral structure.
- B There are a total of 6 bonding electrons.
- C There is only covalent bond present.
- D There is a lone pair of electrons around the sulfur atom.

19 How many σ and π bonds are present in the circled part of the molecule?

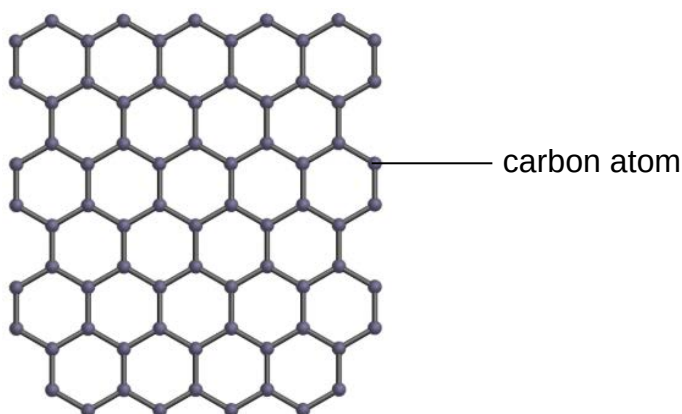


	σ bonds	π bonds
A	1	3
B	1	2
C	2	1
D	3	1

20 Which of the following is **not** true about a molecule of ammonia, NH_3 ?

- A Electron density shifts towards N.
- B Its shape is trigonal pyramidal.
- C Its molecules can form hydrogen bonding.
- D There is a net dipole moment of zero.

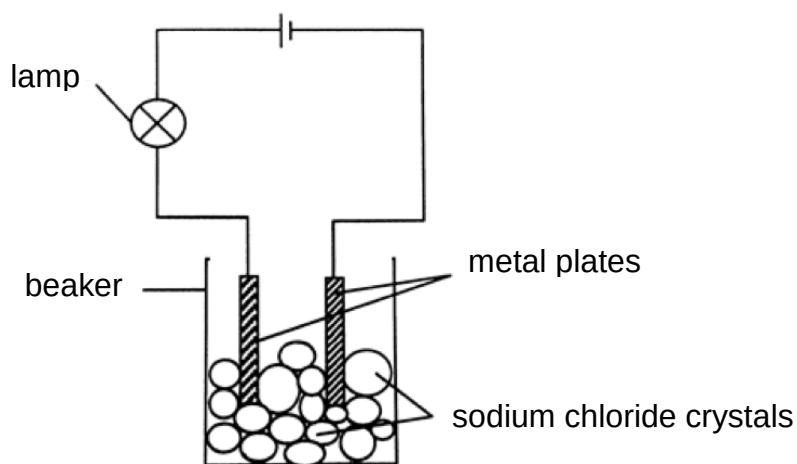
- 21** The diagram shows part of graphene, an allotrope of carbon, in which the atoms are arranged in a honeycomb-shaped lattice.



Which of the following could be some of the properties of graphene?

	melting point	electrical conductivity
A	high	poor
B	low	poor
C	low	good
D	high	good

- 22** A test for sodium chloride crystals is set up as shown below.

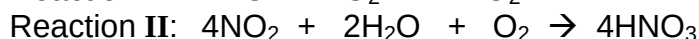


The lamp was not lit at the beginning. The lamp then lit up when distilled water was added.

Which is the best possible explanation for this observation?

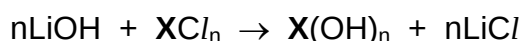
- A** Water self-ionises and is able to conduct electricity.
- B** Sodium atoms lose electrons and are able to conduct electricity.
- C** Electrons are free to move in the solution when sodium chloride dissolves.
- D** Ions are free to move in the solution when sodium chloride dissolves.

- 23** Two of the reactions used in the manufacture of nitric acid, HNO_3 , are shown.



What is the maximum number of moles of nitric acid which could be formed from one mole of nitrogen monoxide, NO ?

- A** 0.5
B 1.0
C 2.0
D 4.0
- 24** Aqueous lithium hydroxide reacts with a chloride of unknown metal **X**, XCl_n , to form a precipitate of the metal hydroxide.



25.0 cm^3 of 1.50 mol dm^{-3} lithium hydroxide solution was found to react exactly with 50.0 cm^3 of $0.250 \text{ mol dm}^{-3}$ XCl_n solution.

What is the formula of the metal chloride?

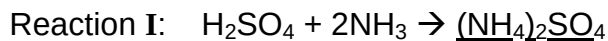
- A** XCl
B XCl_2
C XCl_3
D XCl_4
- 25** An impure sample of sodium carbonate weighing 5 g was dissolved in 500 cm^3 of water (in excess) to produce a solution.

25.0 cm^3 of this solution was completely reacted by 20.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ hydrochloric acid.

What was the percentage purity of the sodium carbonate used?

- A** 36%
B 42%
C 71%
D 85%

- 26** Below are the overall equations for the manufacture of two fertilisers (underlined).



The relative molecular mass, M_r , of each fertilizer is shown in the table.

	$(\text{NH}_4)_2\text{SO}_4$	$\text{Ca}(\text{H}_2\text{PO}_4)_2$
M_r	132.1	234.1

In each reaction, 294 g of sulfuric acid was used, while the other reagent in the reaction was added in excess.

What is the theoretical yield of each of the respective fertilisers?

	$(\text{NH}_4)_2\text{SO}_4$	$\text{Ca}(\text{H}_2\text{PO}_4)_2$
A	396 g	702 g
B	396 g	351 g
C	198 g	702 g
D	198 g	351 g

- 27** Aspirin tablets have important medical uses such as reducing fever and relieving pain.

Aspirin, $\text{C}_9\text{H}_8\text{O}_4$, is made from salicylic acid, $\text{C}_7\text{H}_6\text{O}_3$, according to the equation:

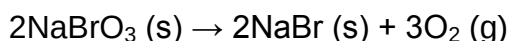


Assuming a 70% yield, what is the mass of salicylic acid required to make an aspirin tablet of 0.325 g?

[M_r of $\text{C}_7\text{H}_6\text{O}_3 = 138.0$, M_r of $\text{C}_9\text{H}_8\text{O}_4 = 180.0$]

- A** 0.174 g
- B** 0.249 g
- C** 0.356 g
- D** 0.464 g

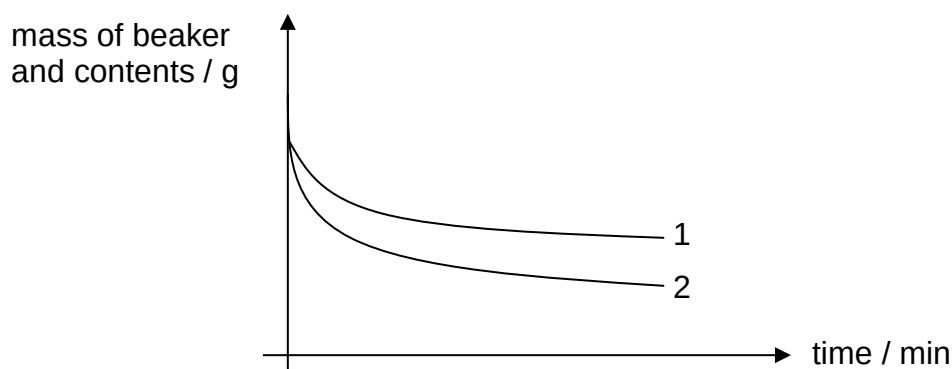
- 28** When sodium bromate(V), NaBrO_3 , is heated, it reacts according to the equation below.



What amount, in mol, of NaBrO_3 produces 58.9 cm^3 of oxygen gas, measured at room temperature and pressure?

- A** 0.00164
- B** 0.00368
- C** 1.64
- D** 3.68

- 29** Excess marble chips were added to a beaker of dilute hydrochloric acid on an electronic balance. A graph of the mass of the beaker and contents was plotted against time (curve 1).

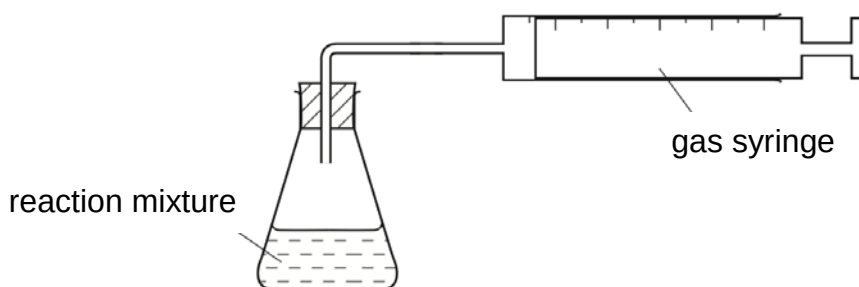


What change in the experiment could give curve 2?

- I** Double the mass of marble chips was used but in smaller pieces.
- II** The same volume of a more concentrated hydrochloric acid was used.
- III** The reaction was carried out at a higher temperature.

- A** I only
- B** II only
- C** I and III
- D** II and III

- 30** The apparatus shown can be used to measure the rate of some chemical reactions.



For which reaction(s) would this apparatus be suitable?

- reaction 1 $2\text{H}_2\text{O}_2 (\text{aq}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + \text{O}_2 (\text{g})$
- reaction 2 $\text{MgO} (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{MgCl}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l})$
- reaction 3 $\text{ZnCO}_3 (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{ZnCl}_2 (\text{aq}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{l})$

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

End of paper

The Periodic Table of Elements

Group																	
1	2															17	18
1 Hhydrogen1.0																	
Key atomic number atomic symbol name relative atomic mass																	
3	4															9	10
Li lithium 6.9	Be beryllium 9.0															F fluorine 19.0	Ne neon 20.2
11	12															17	18
Na sodium 23.0	Mg magnesium 24.3															Cl chlorine 35.5	Ar argon 39.9
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K potassium 39.1	Ca calcium 40.1	Sc scandium 45.0	Ti titanium 47.9	V vanadium 50.9	Cr chromium 52.0	Mn manganese 54.9	Fe iron 55.8	Co cobalt 58.9	Ni nickel 58.7	Cu copper 63.5	Zn zinc 65.4	Ga gallium 69.7	Ge germanium 72.6	As arsenic 74.9	Se selenium 79.0	Br bromine 79.9	Kr krypton 83.8
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb rubidium 85.5	Sr strontium 87.6	Y yttrium 88.9	Zr zirconium 91.2	Nb niobium 92.9	Mo molybdenum 95.9	Tc technetium —	Ru ruthenium 101.1	Rh rhodium 102.9	Pd palladium 106.4	Ag silver 107.9	Cd cadmium 112.4	In indium 114.8	Sn tin 118.7	Sb antimony 121.8	Te tellurium 127.6	I iodine 126.9	Xe xenon 131.3
55	56	57–71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs caesium 132.9	Ba barium 137.3	lanthanoids				Re rhenium 186.2	Os osmium 190.2	Ir iridium 192.2	Pt platinum 195.1	Au gold 197.0	Hg mercury 200.6	Tl thallium 204.4	Pb lead 207.2	Bi bismuth 209.0	Po polonium —	At astatine —	Rn radon —
87	88	89–103	104	105	106	107	108	109	110	111	112						
Fr francium —	Ra radium —	actinoids	Rf rutherfordium —	Db dubnium —	Sg seaborgium —	Bh bohrium —	Hs hassium —	Mt meitnerium —	Ds darmstadtium —	Rg roentgenium —	Cn copernicium —						
lanthanoids																	
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71			
La lanthanum 138.9	Ce cerium 140.1	Pr praseodymium 140.9	Nd neodymium 144.2	Pm promethium —	Sm samarium 150.4	Eu europium 152.0	Gd gadolinium 157.3	Tb terbium 158.9	Dy dysprosium 162.5	Ho holmium 164.9	Er erbium 167.3	Tm thulium 168.9	Yb ytterbium 173.1	Lu lutetium 175.0			
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103			
Ac actinium —	Th thorium 232.0	Pa protactinium 231.0	U uranium 238.0	Np neptunium —	Pu plutonium —	Am americium —	Cm curium —	Bk berkelium —	Cf californium —	Es einsteinium —	Fm fermium —	Md mendelevium —	No nobelium —	Lr lawrencium —			
actinoids																	