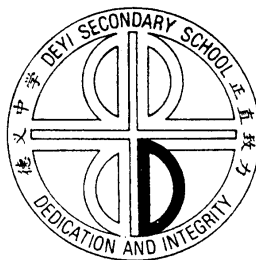


Name :

DEYI SECONDARY SCHOOL

Preliminary Examination 2020
Secondary Four Express

Chemistry

6092/01

31 August 2020
1100 – 1200h
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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 OTAS.

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

The use of an approved scientific calculator is expected, where appropriate.

1 Which property can be used to determine the purity of glycerol?

- A boiling point
- B colour
- C scent
- D solubility in water

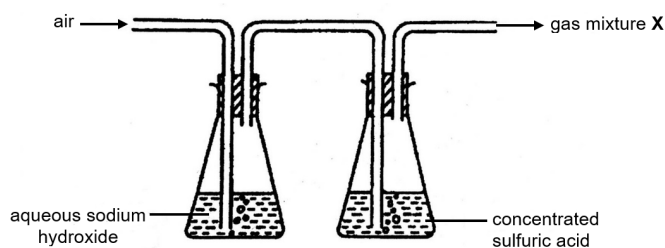
2 The properties of two miscible compounds A and B are shown.

property	compound A	compound B
melting point / °C	19.5	21.4
boiling point / °C	81.0	86.6
solubility in water	slightly soluble	soluble
solubility in propanol	soluble	slightly soluble

Which is the best method to separate a mixture of the two compounds?

- A chromatography
- B fractional distillation
- C simple distillation
- D separating funnel

3 In the experiment shown, a sample of air was passed through the set-up and gas mixture **X** was collected.



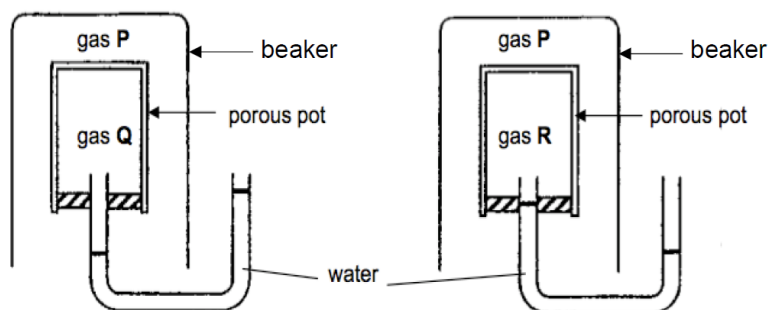
What is the correct composition of gas mixture **X**?

- A carbon dioxide and water vapour
- B nitrogen and noble gases
- C nitrogen and water vapour
- D nitrogen, oxygen and noble gases

4 Which of the following occurs when iodine sublimes?

- A distance between iodine particles increases
- B forces of attraction between iodine particles become stronger
- C iodine particles become lighter
- D iodine particles begin to be arranged in a more orderly manner

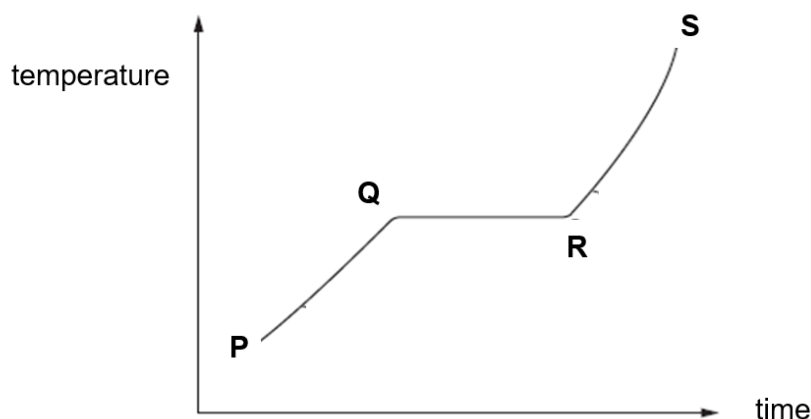
- 5 The apparatus can be used to show the diffusion of gases. Two beakers containing gas **P** were placed over two porous pots containing gases **Q** and **R** respectively. The results are shown below.



What is the correct order of the relative molecular mass, M_r of gases **P**, **Q** and **R**?

	lowest M_r highest M_r		
A	P	Q	R
B	Q	P	R
C	R	P	Q
D	R	Q	P

- 6 The heating curve of solid **X** is shown below.



Which state(s) would substance **X** exist in between points **R** to **S**?

- A** gaseous state only
- B** liquid and gaseous states
- C** liquid state only
- D** solid and liquid states

7 Which group of substances contains an element, a mixture and a compound?

- A air, pure water, ammonia
- B copper, air, magnesium chloride
- C pure water, sulfur, magnesium
- D sulfur, copper(II) sulfate, ammonia

8 Which statement is **incorrect**?

- A A proton has an opposite charge to an electron.
- B A proton has the same mass as a neutron.
- C All hydrogen atoms contain one proton.
- D An electron is 1840 times heavier than a proton.

9 The following table lists the atomic structure of four particles **W**, **X**, **Y** and **Z**.

particle	proton	electron	neutron
W	7	10	7
X	7	7	8
Y	7	10	8
Z	8	8	8

Which two particles are isotopes of each other?

- A **W** and **Y**
- B **X** and **Y**
- C **X** and **Z**
- D **Y** and **Z**

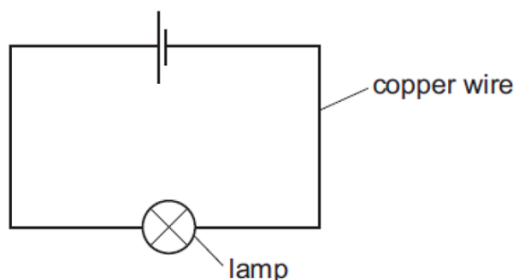
10 Which of the following statements is true?

- A F^- has more electrons than Na^+ .
- B Fe^{3+} has more electrons than Fe^{2+} .
- C Ne has more electrons than F^- .
- D N^{3-} has more electrons than N.

11 Which pair of elements will form a compound with a high melting point?

- A barium and zinc
- B calcium and argon
- C carbon and hydrogen
- D fluorine and sodium

12 An electrical circuit is connected as shown below and the lamp lights up.



Which process takes place in the copper wire?

- A Electrons move towards the negative terminal of the battery, positive ions stay in position.
- B Electrons move towards the positive terminal of the battery, positive ions move towards the negative terminal of the battery.
- C Electrons move towards the positive terminal of the battery, positive ions stay in position.
- D Negative ions move towards the positive terminal of the battery, positive ions move towards the negative terminal of the battery.

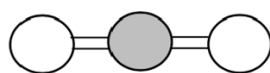
13 A student wrote four statements about sodium and chlorine, as shown below.

- (i) A sodium ion has the same number of valence electrons as a chloride ion.
- (ii) The number of protons in a sodium ion is greater than that in a sodium atom.
- (iii) A chloride ion has the same number of electron shells as a chlorine atom.
- (iv) A chlorine atom gains one proton to form a chloride ion.

Which statement(s) is(are) correct?

- A (i) and (iii) only
- B (i) and (iv) only
- C (ii) only
- D (iii) and (iv) only

- 14 The models shown below represent two molecules.



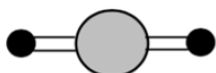
XY_2



YZ_2

Which model correctly represents the molecule formed between **X** and **Z**?

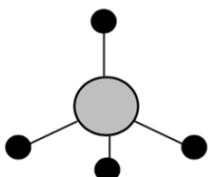
A



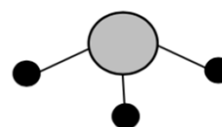
B



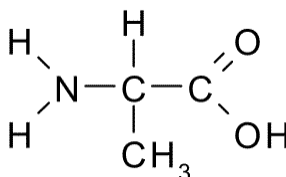
C



D



- 15 An amino acid, alanine, has the following structure.



How many pairs of valence electrons are **not** involved in bonding in the alanine molecule?

- A** 4
B 5
C 9
D 10
- 16 The relative molecular mass of a compound with the formula $K_3Co(CN)_x$ is 332. What is the value of **x**?

- A** 3
B 4
C 5
D 6

- 17 What volume and concentration of dilute sulfuric acid is needed to completely neutralise 25.0 cm³ of 0.1 mol/dm³ aqueous sodium hydroxide?

	volume of sulfuric acid / cm ³	concentration of sulfuric acid / mol/dm ³
A	25.0	0.05
B	25.0	0.10
C	50.0	0.05
D	50.0	0.10

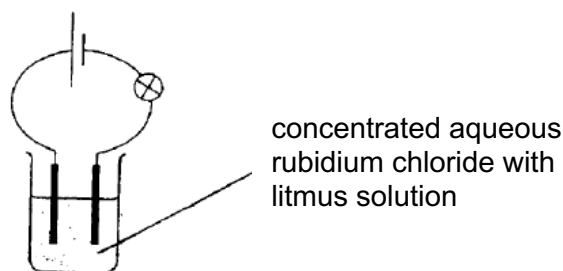
- 18 A 5.0 g sample of a mixture of sand and calcium carbonate was heated strongly in an open flask until there was no further change in mass. What is the percentage calcium carbonate in the mixture if the final recorded mass was 4.2 g?

- A 36%
B 52%
C 72%
D 84%

- 19 40 cm³ of a gaseous oxide of nitrogen were decomposed completely into 40 cm³ of nitrogen and 20 cm³ of oxygen at the same temperature and pressure. What is the formula of the oxide?

- A NO
B NO₂
C N₂O
D N₂O₃

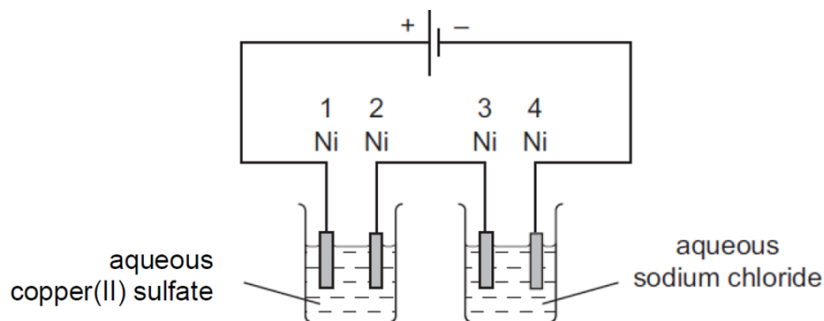
- 20 A few drops of litmus solution were added to a beaker of concentrated aqueous rubidium chloride in the set-up shown below.



Which statement correctly describes the set-up shown above?

- A A grey solid is deposited at the anode.
B A yellowish-green gas is evolved at the cathode.
C The pH of the liquid in the beaker decreases.
D The solution around the cathode turns blue.

- 21 Four nickel electrodes are used in an experiment as shown below.



Which nickel electrode(s) will be electroplated with a different metal?

- A 1 only
B 1 and 3 only
C 2 only
D 2 and 4 only
- 22 In an experiment, a student observed that a sample of methane gas reacted very slowly with air at room temperature. In a second experiment, he held a piece of warm platinum next to the methane-air mixture and the methane ignited. The student wrote the following statements based on his observations.
- (i) The activation energy of the second reaction is lower.
(ii) The overall enthalpy change of the first reaction is higher.
(iii) The energy level of the products in the first reaction is lower.
(iv) The rate of the second reaction is faster.

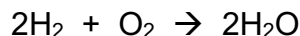
Which statements are correct?

- A (i) and (ii) only
B (i) and (iv) only
C (ii) and (iii) only
D (ii) and (iv) only

- 23** A list of bond energies is shown in the Table below.

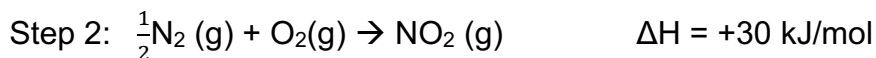
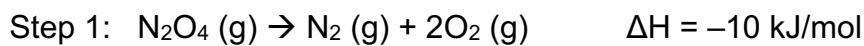
chemical bond	bond energy (kJ/mol)
O – H	110
O = O	142
H - H	104

Hydrogen and oxygen react according to the following equation.



With reference to the bond energies, what is the enthalpy change of the reaction between hydrogen and oxygen?

- A** - 440 kJ/mol
B - 90 kJ/mol
C + 26 kJ/mol
D + 350 kJ/mol
- 24** A two-step reaction is represented in the equations below.



What is the enthalpy change for the complete decomposition of N_2O_4 to form NO_2 ?

- A** -50 kJ/mol
B +20 kJ/mol
C +50 kJ/mol
D +70 kJ/mol
- 25** In which reaction is pressure least likely to affect the rate of reaction?

- A** $\text{C} (\text{s}) + \text{CO}_2 (\text{g}) \rightarrow 2\text{CO} (\text{g})$
B $\text{N}_2 (\text{g}) + 3\text{H}_2 (\text{g}) \rightarrow 2\text{NH}_3 (\text{g})$
C $\text{NaOH} (\text{aq}) + \text{HCl} (\text{aq}) \rightarrow \text{NaCl} (\text{aq}) + \text{H}_2\text{O} (\text{l})$
D $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2\text{SO}_3 (\text{g})$

- 26** Copper(II) oxide is a catalyst for the decomposition of potassium chlorate(V), producing oxygen gas. Which statement explains why the rate of oxygen production decreases during the reaction?

A copper(II) oxide is used up
B potassium chlorate(V) solution becomes more dilute
C reaction is endothermic
D surface area of copper(II) oxide decreases

- 27** Which pair of descriptions is correct?

	colour change when potassium iodide is oxidised	colour change when acidified potassium manganate(VII) is reduced
A	brown to colourless	colourless to purple
B	brown to colourless	purple to colourless
C	colourless to brown	colourless to purple
D	colourless to brown	purple to colourless

- 28** The ionic equation for the reaction of Mn_2O_3 in acidic conditions is shown below:



Which statement about this reaction is correct?

A H^+ is a reducing agent.
B H^+ gains electrons to form H_2O .
C The oxidation state of oxygen in H_2O is -1.
D The oxidation state of manganese in Mn_2O_3 is +3.

- 29** Which substance is best used to differentiate between nitric acid and hydrochloric acid solutions?

A aqueous ammonium carbonate
B barium nitrate solution
C magnesium metal
D silver nitrate solution

- 30** A black powder is burnt in air. The gas produced dissolves in water to form solution **R**, whose pH is close to 7. The gas is also very readily absorbed by aqueous sodium hydroxide. What type of substance is present in solution **R**?

A strong acid
B strong base
C weak acid
D weak base

- 31** Different solids were added to separate portions of warm dilute hydrochloric acid. For which solid is the observation correct?

	solid	observation
A	ammonium sulfate	alkaline gas produced
B	calcium carbonate	gas evolved relights a glowing splint
C	copper(II) oxide	solid dissolves with no effervescence
D	silver	gas evolved extinguishes a lighted splint with a 'pop' sound

- 32** Which statement is **not** true of the Haber Process?

A Hydrogen for the Haber Process is obtained from air.
B Optimum pressure for the Haber Process is 250 atm.
C The Haber Process involves the use of a catalyst.
D The Haber Process is a reversible reaction.

- 33** Nitrogen and hydrogen gases react to form ammonia gas in the Haber process. A higher yield of ammonia is favoured by a lower temperature but in industry, a high temperature of 450°C is used. Why is this so?

A At high temperatures, gases expand and less volumes are needed.
B At high temperatures, the catalyst is more effective.
C At low temperatures, liquid ammonia is collected instead.
D At low temperatures, the rate of reaction is too slow.

- 34** Selenium, Se, is in the same Group of the periodic table as sulfur. What is the formula of potassium selenide?

A K_2Se
B KSe_4
C K_2Se_4
D KSe_3

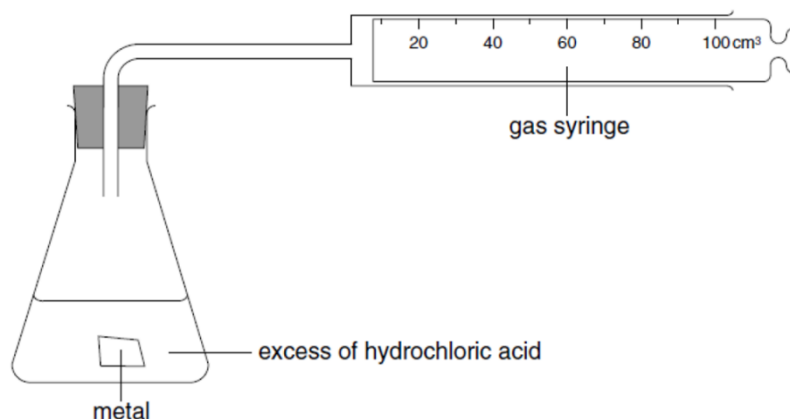
35 Some properties of metals are listed below.

- (i) malleable and ductile
- (ii) form coloured compounds
- (iii) good conductors of electricity
- (iv) show variable oxidation states

Which properties describe transition metals but **not** alkali metals?

- A (i) and (ii) only
- B (i) and (iii) only
- C (ii) and (iv) only
- D (iii) and (iv) only

36 An experiment is set up as shown below.



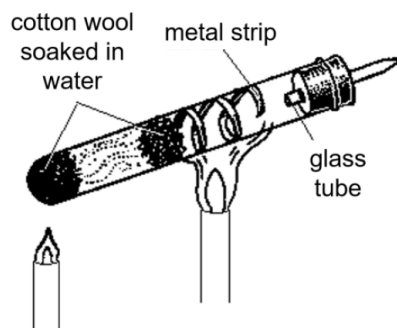
Which metal would result in the production of 100 cm³ of gas in the shortest time?

- A 5 g of copper
- B 5 g of iron
- C 5 g of lead
- D 5 g of magnesium

37 Which pair of substances **cannot** be used to form an alloy?

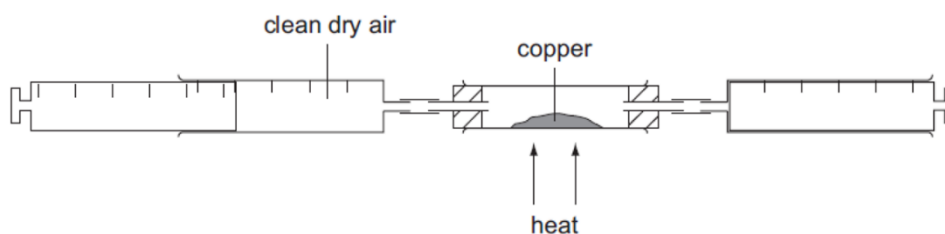
- A aluminium and magnesium
- B carbon and iron
- C copper and zinc
- D sodium and fluorine

- 38 The diagram below shows part of the apparatus set-up of an experiment. A strip of metal was heated in a test-tube. When a spark was created at the outlet of the glass tube, no flame was observed.



Which of the following metal could be in the test-tube?

- A calcium
 - B magnesium
 - C tin
 - D zinc
- 39 Which is the best method to reduce acid rain formation?
- A enforce a total ban on coal-firing power stations
 - B ensure that all power stations using fossil fuels adopt flue gas desulfurisation
 - C introduce ammonia gas into the atmosphere
 - D use solar energy as the main energy source
- 40 A student set up an experiment as shown below.



The volume of clean dry air decreases until it reaches a constant volume. The student observed that the final volume of air is 30 cm^3 less than the initial volume. What was the initial volume of air in the syringe?

- A 60 cm^3
- B 100 cm^3
- C 150 cm^3
- D 300 cm^3

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H hydrogen 1																	
Key proton (atomic) number atomic symbol name relative atomic mass																	
3 Li lithium 7	4 Be beryllium 9																
11 Na sodium 23	12 Mg magnesium 24																
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	209	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
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 -

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).