

Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name
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新加坡海星中学
MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

CHEMISTRY

Paper 1 Multiple Choice

6092/01

30 August 2023

1 hour

Additional Materials:

Optical Test Answer Sheet (OTAS) – 1 sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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 answer 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 question booklet.

A copy of the Periodic Table is printed on page 16.

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

The total number of marks for this paper is 40.

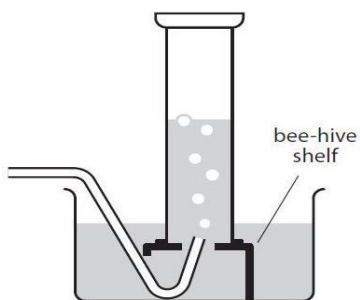
At the end of the examination, hand in the following separately:

(1) Optical Test Answer Sheet (OTAS)

(2) Question Paper

- 1 Gases produced in chemical reactions can be collected for future usage.

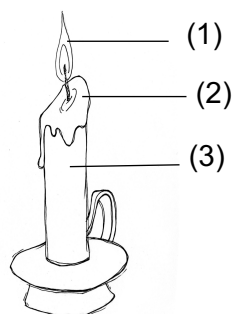
An experiment was conducted where reactants were placed into a conical flask and the gas produced was collected using displacement of water method as shown below.



Which of the following reactions is this method not suitable?

- A decomposition of aqueous hydrogen peroxide
 - B decomposition of calcium carbonate
 - C reacting magnesium metal with dilute sulfuric acid
 - D reacting ammonium chloride and dilute potassium hydroxide
- 2 Which of the following pairs of substances can be separated by heating?
- A ammonium chloride and sodium chloride
 - B ammonium chloride and solid iodine
 - C magnesium oxide and silver carbonate
 - D magnesium oxide and copper

- 3 The diagram below shows a burning candle.



Which of the following shows the correct description of the movement of the particles in (1), (2) and (3)?

	(1)	(2)	(3)
A	particles move randomly in any direction	particles vibrate in fixed positions	particles can rotate and slide over one another
B	particles move randomly in any direction	particles can rotate and slide over one another	particles vibrate in fixed positions
C	particles can rotate and slide over one another	particles move randomly in any direction	particles vibrate in fixed positions
D	particles vibrate in fixed positions	particles can rotate and slide over one another	particles move randomly in any direction

- 4 Chromatography was used to separate a mixture containing two dyes. The R_f values of two dyes are given in the following table.

dye	X	Y
R_f	0.60	0.40

If dye X moves a distance of 9 cm from the starting line, what is the distance between dyes X and Y on the same chromatogram?

- A** 1 cm **B** 2 cm **C** 3 cm **D** 4 cm

- 5 The solubility of four solids, P, Q, R and S are as shown in the table below.

	P	Q	R	S
solubility in water	soluble	insoluble	insoluble	soluble

Kevin tried to separate mixtures of these solids using the following steps.

- 1) Add the mixture to a beaker of water and stir.
- 2) Filter the mixture.
- 3) Obtain one of the solids from the mixture using crystallisation.

Which of the following mixtures could not be separated by this method?

- A P and R
- B Q and P
- C Q and R
- D R and S

- 6 An ion X^{3-} has a mass number of m and n electrons.

What does the nucleus of an atom of X contain?

	number of protons	number of neutrons
A	$n - 3$	$n - m$
B	$n - 3$	$m - (n - 3)$
C	$n + 3$	$m - (n + 3)$
D	$n + 3$	$m + n$

- 7 A sample of silver metal consists of 2 stable isotopes, 51.8% of silver-107 and 48.2% of silver-109. What is the average relative atomic mass of the metal?

- A 106
- B 107
- C 108
- D 109

- 8 Which of the following consists of compounds only?
- A silver nitrate, copper(II) sulfate solution, magnesium oxide
 - B carbon monoxide, propane, carbon dioxide
 - C bronze, steel, pewter
 - D graphite, calcium, limestone
- 9 When a saturated aqueous solution of ammonium cobalt(II) sulfate hexahydrate, $(\text{NH}_4)_2\text{Co}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ is cooled from 60°C to room temperature, crystals are formed. Which statement about this process is correct?
- A The mass of the solvent in the solution increases.
 - B The concentration of the solution remains the same.
 - C The mass of the solute dissolved in the solution decreases.
 - D The solubility of the solute increases as the temperature falls.
- 10 Which of the following consists of substance containing both ionic and covalent bonds?
- | | |
|----------------------|----------------------|
| A aluminium sulfate | B beryllium chloride |
| C sulfur dioxide gas | D chromium oxide |
- 11 Capsaicin, which is found in chilli and pepper, causes the spicy burning sensation in the mouth.

It has the molecular formula $\text{C}_{18}\text{H}_{27}\text{NO}_3$ and has a melting point of 65°C .

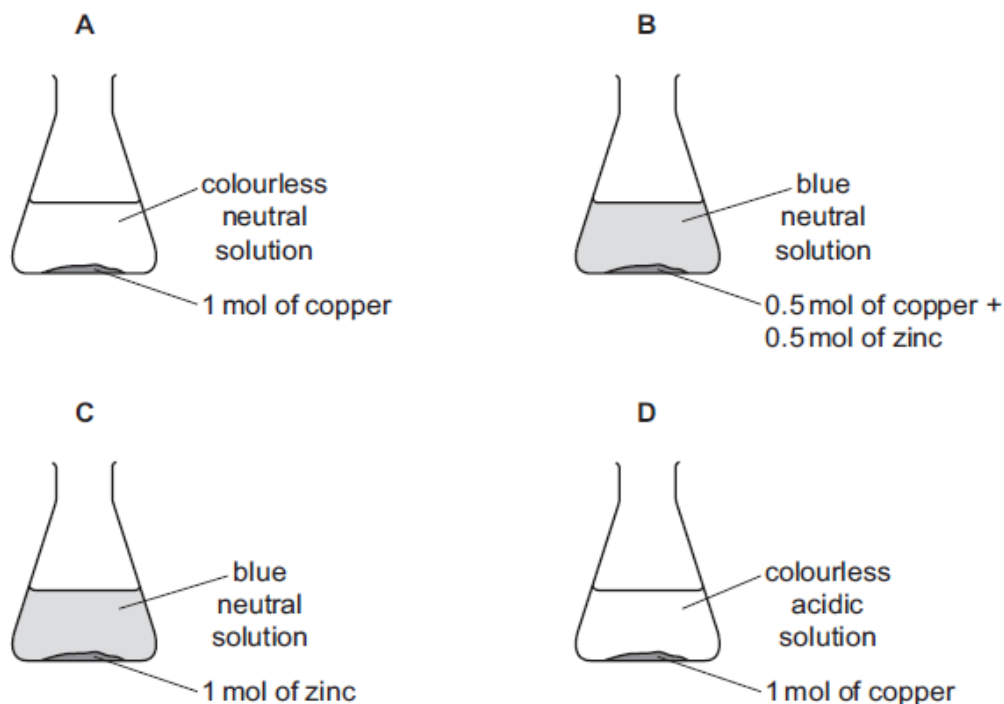
Which of the following statements best explains why drinking water is ineffective in removing the burning sensation caused by capsaicin?

- A Capsaicin has a giant molecular structure and is soluble in water.
- B Capsaicin has a giant molecular structure and is not very soluble in water.
- C Capsaicin has a simple molecular structure and is soluble in water.
- D Capsaicin has a simple molecular structure and is not very soluble in water.

- 12 In an experiment, 1 mol of powdered copper and 1 mol of powdered zinc are placed in a flask. 3 mol of hydrochloric acid is then added to the flask.

The flask is left until all the reactions, if any, are completed.

Which diagram shows the results of the experiment?



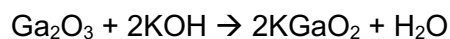
- 13 49.2 g of hydrated magnesium sulfate is heated and cooled repeatedly until it reaches a constant mass of 24.0 g.

Assuming only water of crystallisation is lost when hydrated magnesium sulfate is heated, what is the formula of the hydrated magnesium sulfate? (A_r of Mg=24, S=32, O=16, H=1)

- A $\text{MgSO}_4 \cdot \text{H}_2\text{O}$
- B $\text{MgSO}_4 \cdot 3\text{H}_2\text{O}$
- C $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$
- D $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$

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

18 Y is a black solid with formula Ga_2O_3 . A reaction took place as followed.



What is the role of Y in the reaction? It is acting as a/an _____.

- A** acidic oxide
- B** basic oxide
- C** neutral oxide
- D** amphoteric oxide

19 Which of the following can be used to distinguish between a solution of aluminium nitrate and lead(II) nitrate?

- | | |
|-------------------------------|------------------------------------|
| A bromine solution | B aqueous sodium hydroxide |
| C dilute sulfuric acid | D aqueous hydrogen peroxide |

20 Which of the following can be used to test for chlorine gas?

- A** litmus paper
- B** cobalt(II) chloride paper
- C** locating agent
- D** concentrated sulfuric acid

21 Which of the following represents the overall reaction in the hydrogen-oxygen fuel cell?

- A** $\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$
- B** $2\text{H}_2\text{O}_2 \rightarrow \text{O}_2 + 2\text{H}_2\text{O}$
- C** $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- D** $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

- 22** A study of a precipitation reaction between aqueous lead(II) nitrate and dilute sulfuric acid of the same concentration was conducted.

Test tubes 1 to 4 contain different volumes of aqueous lead(II) nitrate and dilute sulfuric acid.

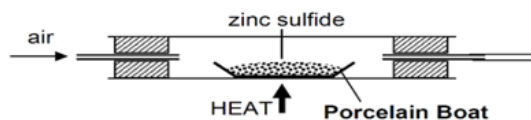
Precipitation occurs in all test tubes and after 10 minutes, the height of the precipitate in each test tube is measured and recorded.

Test tube	1	2	3	4
volume of aqueous lead (II) nitrate / cm ³	5.0	5.0	5.0	5.0
volume of sulfuric acid / cm ³	3.0	4.0	5.0	6.0
height of precipitate / cm	3.0	3.5	4.0	4.0

At the end of reaction, which test tube contains excess sulfuric acid?

- | | | | |
|----------|---|----------|---|
| A | 1 | B | 2 |
| C | 3 | D | 4 |

- 23** Zinc is extracted from its ore, zinc sulfide, which is heated in air to form zinc oxide and a gas. This was carried out in a laboratory using the apparatus shown.



What are the observations in the porcelain boat and gas formed while zinc sulfide is being heated?

	solid in porcelain boat	gas formed
A	turns yellow	sulfur dioxide
B	turns yellow	oxygen
C	turns grey	oxygen
D	turns white	sulfur dioxide

- 25** Which of the following property does not describe a property of Group I elements?

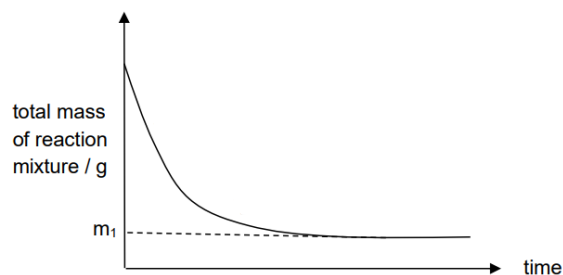
- 26** In separate experiments conducted, a gaseous halogen was bubbled into an aqueous solution of a halide salt. The following results were observed.

experiment	halogen added	halide solution		
		X ⁻	Y ⁻	Z ⁻
1	X ₂	-	displaced as Y ₂	displaced as Z ₂
2	Y ₂	no visible reaction		displaced as Z ₂
3	Z ₂	no visible reaction	no visible reaction	

What is the arrangement of the halogens X, Y and Z in group VII, in increasing order of proton number?

- A** X, Y, Z **B** X, Z, Y
C Z, Y, X **D** Y, X, Z

- 27 When excess copper(II) carbonate is added to dilute sulfuric acid, the total mass of the reaction mixture is measured over a period of time as shown in the graph below.

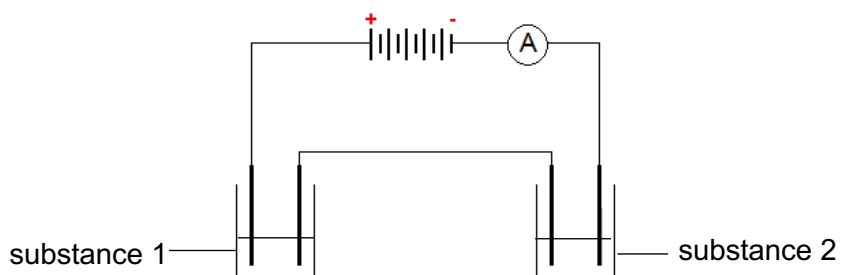


Which is the composition of mass m_1 ?

- A copper(II) sulfate solution
 - B copper(II) sulfate solution and carbon dioxide
 - C copper(II) sulfate solution, unreacted copper(II) carbonate
 - D copper(II) sulfate solution, excess dilute sulfuric acid
- 28 Nitric acid, HNO_3 , can act as a strong oxidising agent. Which of the following cannot be a product of nitric acid in a redox reaction with other substances?
- A N_2
 - B NO
 - C NO_2
 - D N_2O_5
- 29 If the oxidation states of X, Y and Z are +1, +5 and -2 respectively, what is the value of n, the charge of the ion $(\text{X}_2\text{YZ}_4)^n$?

- A -1
- B -5
- C +1
- D +5

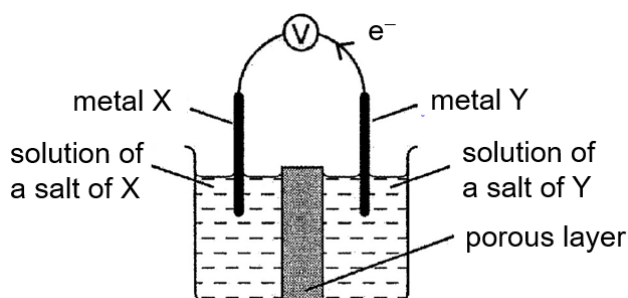
- 30 The following diagram shows an electrolytic cell set-up.



Which of the following pairs of substances in the beakers will give the largest current reading on the ammeter?

	substance 1	substance 2
A	solid potassium chloride	dilute nitric acid
B	dilute sulfuric acid	propanol
C	dilute ethanoic acid	molten aluminium chloride
D	molten magnesium chloride	dilute sulfuric acid

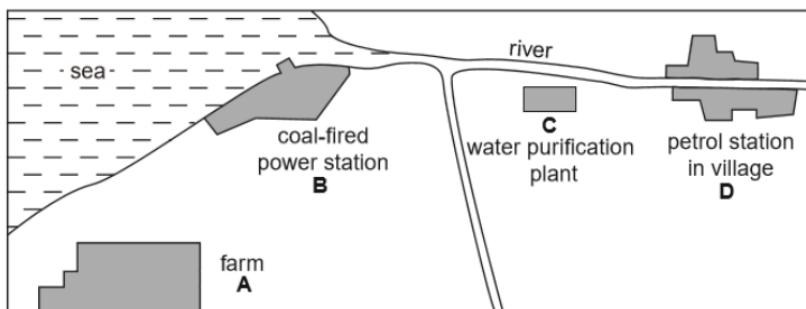
- 31 The direction of electron flow in the simple cell shown below is from metal Y to metal X.



Which pair of metals X and Y will produce the highest voltage when used as electrodes in the simple cell?

	metal X	metal Y
A	copper	aluminium
B	iron	magnesium
C	iron	zinc
D	silver	magnesium

- 32 Which place on the map is most likely to be producing large quantities of sulfur dioxide?



- 33 To reduce atmospheric pollution, the following waste gases from a coal-burning power station are passed through aqueous calcium hydroxide.

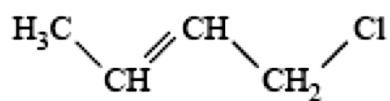
carbon dioxide	carbon monoxide	nitrogen dioxide
sulfur dioxide	phosphorus(V) oxide	propene

How many waste gases will not be removed by the above process?

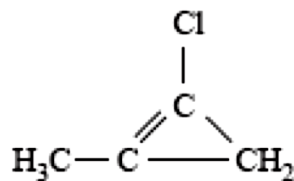
- A** 2 **B** 3 **C** 4 **D** 5
- 34 Which air pollutant irritates, damages the lungs and is a cause of acid rain?
- A** carbon monoxide
B oxides of nitrogen
C methane
D ozone
- 35 Which of the following releases heat and involves the smallest change in volume for the same mass of substance?
- A** condensation **B** sublimation
C boiling **D** freezing
- 36 An unsaturated organic acid P has the formula $C_{17}H_{29}COOH$. How many double bonds are present between carbon atoms in each molecule of P?

- A** 2 **B** 3 **C** 4 **D** 5

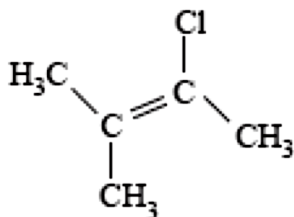
37 Some molecules are shown below.



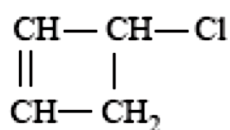
(I)



(II)



(III)



(IV)

Which of the following represents a pair of isomers?

- A I and II
- B I and III
- C I and IV
- D II and IV

38 A group of students wrote the names of some esters as shown below.

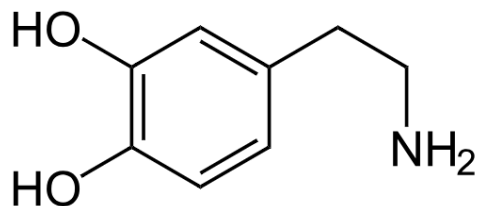
- I methyl ethanoate
- II ethyl propanoate
- III ethyl methanoate
- IV propyl methanoate

Which esters have the same molecular formula, $\text{C}_3\text{H}_6\text{O}_2$?

- A I and II
- B I and III
- C II and IV
- D III and IV

- 39** Dopamine is a chemical released in the brain that makes you feel good. Having the right amount of dopamine is important both for your body and your brain.

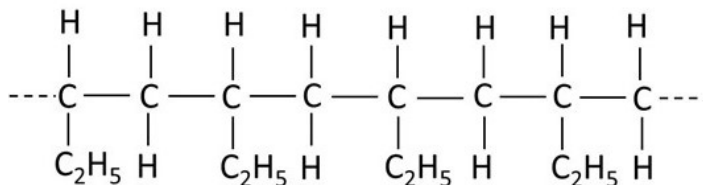
The full structural formula of dopamine is as shown below.



Which of the following substances can dopamine react with?

- | | |
|-------------------|------------------|
| A nitrogen | B oxygen |
| C butane | D ammonia |

- 40** Part of a polymer has the structure as shown below.



What is the molecular formula of the monomer?

- A** C₂H₆
B C₃H₈
C C₄H₈
D C₈H₁₆

End of Paper

The Periodic Table of Elements

Group																		
I	II											III	IV	V	VI	VII	0	
		1 H hydrogen 1																
		proton (atomic) number atomic symbol name relative atomic mass																
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	113 Nh nihonium		114 Fl flerovium	115 Lv livermorium -	116 Ts tennessine	117 Uu unseptennium

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.).