O Level Centre Number/ Index Number | Class

Name



新加坡海星中学 MARIS STELLA HIGH SCHOOL PRELIMINARY EXAMINATION SECONDARY FOUR

SCIENCE (PHYSICS, CHEMISTRY)

Paper 1 Multiple Choice

5086/01 23 August 2024 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 name, class and index number on the Answer Sheet.

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 booklet.

A copy of the Data Sheet is printed on page **20**. A copy of the Periodic Table is printed on page **21**.

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

This document consists of **21** printed pages and **1** blank page.

- $\label{eq:alpha} {f A} \ \ 0.0001 \ cm \qquad {f B} \ \ 0.1 \ mm \qquad {f C} \ \ 100 \ nm \qquad {f D} \ \ 1000 \ \mu m$
- 2 The diagram shows a distance-time graph of a car.



In which region is the car accelerating?

- A V to W
- B W to X
- C X to Y
- D Y to Z
- 3 Which statement about mass and weight is correct?
 - A Mass is a scientific term that means the same as weight.
 - **B** The mass of an object on Earth is 10 times its weight.
 - **C** Weight is a scalar quantity, mass is a vector quantity.
 - **D** Weight is the force of gravity pulling on a mass.
- 4 The driving force on a moving car of mass 1000 kg is 2000 N. The car is moving along a level road. The frictional force opposing the motion is 1500 N.

What are the values of the acceleration and the resultant force?

	acceleration m / s ²	resultant force / N
Α	0.50	500
в	0.50	2000
С	2.00	500
D	2.00	2000

5 The diagram below shows a device used to convert old newspapers into blocks that can be burnt.

A force F is exerted at the end of the handle which allows the plate in contact with the newspapers to squeeze water out of it.



What is the magnitude of the force F if the pressure exerted on the paper is 7200 N/m²?

Α	60 N	В	180 N	С	360 N	D	540 N
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6 The snatch is the first of two lifts contested in the sport of weightlifting. The current record holder for the 73 kg class for the snatch is Shi Zhiyong from China. At the Asian Championships in 2021, he lifted a weight of 1690 N through a height of 1.6 m in 2.6 s.

The diagram below shows Shi Zhiyong lifting the barbell from the ground to overhead in one continuous motion.



What is his average power during the snatch?

A 450 W **B** 304 W **C** 1040 W **D** 7030 W

7 A block of ice is melting.

What happens to the potential energy and kinetic energy of the molecules?

	potential energy	kinetic energy
Α	increase	no change
в	increase	increase
С	no change	no change
D	no change	increase

8 An emergency foil blanket is a low-weight blanket made of heat-reflective thin plastic to retain body heat for victims in shock or for prevention of shock.

The diagram below shows a man in an emergency blanket.



Which of the following statements correctly describe how the shiny surface of the blanket helps the man retain body heat?

- A Silver surfaces are poor absorbers of heat.
- **B** Silver surfaces are poor conductors of heat.
- **C** Silver surfaces reflect heat from the surroundings.
- D Silver surfaces are poor emitters of heat.

5

- 9 Which diagram shows an example of a longitudinal wave?
 - A a spring pulled backwards and pushed forwards repeatedly



B light travelling from a lamp to a screen



c a spring moved up and down repeatedly



D a water ripple caused by a dipper moving up and down repeatedly



10 The diagram shows the displacement-time graph when a musician plays a single note on a violin.



The same note is then played more loudly.

Which of the following shows its displacement-time graph?



11 A plane mirror is placed at a distance 200 cm in front of a lady. A poster is fixed 70 cm behind the eyes of the lady.



What is the distance of the image of the poster from the lady?

A 70 cm **B** 270 cm **C** 470 cm **D** 540 cm

12 The diagram shows a thin converging lens forming a real image of an object.



What happens to the image as the object is moved further away from the focal point F?

- A It moves further away from the lens and decreases in size.
- **B** It moves further away from the lens and increases in size.
- **C** It moves towards the lens and decreases in size.
- **D** It moves towards the lens and increases in size.
- **13** The diagram shows the main components of the electromagnetic spectrum.

Р	X-rays	Q	visible light	infra-red	R	radio waves
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What are the components P, Q and R?

	Р	Q	R
Α	gamma-rays	microwaves	ultra-violet
в	gamma-rays	ultra-violet	microwaves
С	microwaves	gamma-rays	ultra-violet
D	microwaves	ultra-violet	gamma-rays

14 Many devices produce electromagnetic waves when operating.

Which device produces electromagnetic waves of the highest frequency?

- A mobile phone B sunbed
- C television controller D toaster
- **15** In the circuit shown, 20 J of energy is dissipated by the cell in driving 8.0 C of charge round the circuit.



What is the value of the e.m.f. of the cell?

Α	0.40 V	В	2.5 V	С	28 V	D	160 V

16 The graph shows the voltage-current graphs for three equal lengths of the same material of resistance wire X, Y and Z.



The resistance and cross-section area of the wires change in going from X to Z.

Which	row	describes	these	changes?
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	resistance	cross-sectional area
Α	decreases	decreases
в	decreases	increases
С	increases	decreases
D	increases	increases

17 A student sets up the circuit shown.



The currents measured by the ammeters are shown.

Which equation is correct?

- **A** $I_1 = I_2 + I_3 + I_4$
- **B** $I_1 = I_2 = I_3 = I_4$

C
$$I_2 + I_3 = I_4 + I_1$$

D
$$I_4 = I_1 + I_2 + I_3$$

A II and III only

- **18** A student plugs in a new washing machine to the mains which is fixed with a circuit breaker. When the washing machine starts operating it causes the circuit breaker to trip. The student recalls what he learned in his Physics class and wrote these statements down.
 - I. A circuit breaker contains an electromagnet.
 - **II.** Household appliances are connected in parallel.
 - **III.** The circuit breaker should be connected to the earth wire.
 - IV. The washing machine's body is made of metal hence it needs an earth wire.

Which of the above statements are correct?

- B I, II and III only
- C I, II and IV only D
 - **D** all of the above

19 An experiment to investigate magnetism is shown in the figure below.



The bar magnet X is placed on an electronic balance and the reading is zeroed.

A solenoid is set up above bar magnet X and the electronic balance read 1.6 N when the switch is closed.

An unknown metal bar Y is placed in the solenoid and the reading increased to 2.8 N.

Which of the following shows the orientation of the electrical source and the material of Y?

	Electrical source	Material of Y
Α	4++	copper
В	+ + +	iron
с		copper
D		iron

20 The graph shows how the count rate measured from a radioactive nuclide changes with time.



What is the half-life of this nuclide?

Α	17 minutes	В	25 minutes	С	30 minutes	D	50 minutes
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21 A student planned two experiments.

Experiment 1: To find the concentration of a solution of sodium hydroxide by titration with dilute hydrochloric acid

Experiment 2: To find the rate of the reaction between pieces of calcium carbonate and dilute hydrochloric acid by measuring the volume of gas given off every minute

A flask is provided.

Which other apparatus is needed?

	experiment 1	experiment 2
Α	burette, pipette	balance, measuring cylinder, thermometer
В	burette, pipette	gas syringe, stopwatch
С	beaker, measuring cylinder	gas syringe, stopwatch
D	gas syringe, stopwatch	burette, pipette

22 A student set up the apparatus as shown.



What is the gas that will be collected from the set-up shown?

- A ammonia
- B oxygen
- C carbon dioxide
- D hydrogen chloride

23 Food dyes, 1 and 2 are known to contain one or more of the three substances X, Y and Z. Two chromatograms are developed, one used water as the solvent, and the other used ethanol. The results are shown in the diagram below.



Which of the following statement(s) is/are correct?

- I Substance Z is likely to be pure.
- II The component in Z is more soluble in water than in ethanol.
- III There is a component in sample 1 that is insoluble in water but soluble in ethanol
- A I only
- B II only
- **C** I and III only
- D II and III only
- 24 Which of the following statements accurately explains why nitrogen gas takes on the volume and shape of the container it is stored in?
 - A Nitrogen is an inert substance.
 - **B** Nitrogen is a diatomic molecule.
 - **C** Nitrogen particles can only roll and slide past one another.
 - **D** Nitrogen particles are very far apart and move in a disorderly manner.

25 The diagram below shows a cooling curve of carbon disulfide.



Which of the following statements is incorrect?

- **A** From t_0 to t_1 , the particles are moving further apart.
- **B** The freezing point of carbon disulfide is -112 °C.
- **C** The particles are in a disorderly arrangement at -73 °C.
- **D** The particles can only vibrate about their fixed positions after t₄.
- 26 Which pair of boxes represents an element and a mixture of compounds?



	element	mixture of compounds
Α	Р	т
в	Р	S
С	Q	R
D	Q	Т

15

27 The formulae of the ions of four elements are shown below.

 O^{2-} $F^ Li^+$ Mg^{2+}

Which statement about these ions is correct?

- **A** They have more electrons than protons.
- **B** They all have the same number of electrons in the outer shells.
- **C** They all have the same number of protons in their nuclei.
- **D** They all have the same electronic structure as a noble gas.
- **28** Four particles, W, X, Y and Z have the composition shown in the table below.

particle	number of electrons	atomic number	mass number
W	10	10	20
Х	11	11	23
Y	10	11	23
Z	19	19	39

Which of the following statements are true?

- 1 Particle X gives away one electron to form particle Y.
- 2 Particle W and particle Y are isotopes.
- 3 Substance Z has a lower melting point than substance X.
- A 1 and 2 only
- **B** 1 and 3 only
- C 2 and 3 only
- **D** 1, 2 and 3
- **29** The elements X and Y form the compound X_2Y .

What is the electronic configuration of the atoms X and Y?

	electronic configuration								
	atom of X	atom of Y							
Α	2,1	2,7							
В	2,2	2,7							
С	2,1	2,6							
D	2,2	2,6							

- **30** The formula of the sulfate of element **X** is **X**SO₄. Which of the following is the correct formula for a compound formed between **X** and an oxalate ion, $C_2O_4^{2-}$?
 - **A** X(C₂O₄)₂
 - **B** X₃C₂O₄
 - **C** $X_2(C_2O_4)_3$
 - $\boldsymbol{\mathsf{D}} \qquad \mathsf{X}\mathsf{C}_2\mathsf{O}_4$
- 31 Which properties represent those of an ionic compound?

	conductivity of solid compound	conductivity of molten compound	conductivity of aqueous solution
Α	poor	good	good
В	poor	poor	good
С	good	good	poor
D	good	good	good

32 In a titration, 25.0 cm³ of aqueous potassium hydroxide, KOH, is neutralised by 21.50 cm³ 0.100 mol/dm³ dilute sulfuric acid, H₂SO₄.

What is the concentration of the aqueous potassium hydroxide?

- A 0.002 mol/dm³
- **B** 0.004 mol/dm³
- **C** 0.086 mol/dm³
- **D** 0.172 mol/dm³
- **33** Aluminium saucepans oxidise on the surface to aluminium oxide.

Why can this oxidised layer be removed by both acids and alkalis?

- A Aluminium oxide is basic.
- **B** Aluminium oxide is neutral.
- **C** Aluminium oxide is acidic.
- **D** Aluminium oxide is amphoteric.

- 34 Which reaction is not a redox reaction?
 - A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
 - $\textbf{B} \qquad Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

 - $\label{eq:constraint} \textbf{D} \qquad Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$
- **35** R, S, T and V represent some elements in the simplified Periodic Table below.



Groups 3 to 12

(Note: R, S, T and V are not chemical symbols of the elements.)

Which statement is true?

- **A** S and T have the same number of valence electrons.
- **B** R and V react to form an ionic compound.
- **C** The oxide of R is insoluble in water.
- **D** V has a lower boiling point than T.
- 36 Metal **M** can be obtained from its oxide by heating its ore with carbon.

What could metal **M** be?

- A copper
- B calcium
- C sodium
- D magnesium

37 Four experiments of rusting are shown.



Which two experiments can be used to show that oxygen is needed for iron to rust?

Α	1 and 3	В	2 and 3
С	1 and 4	D	2 and 4

38 Petroleum can be separated into fractions by fractional distillation.

Which statement about this process is not correct?

- A The lubricating oil fraction can be used to make polishes and waxes.
- **B** Bitumen has stronger intermolecular forces of attraction than kerosene.
- **C** The fraction obtained at the top of the fractionating column has the highest boiling point.
- **D** The relative molecular masses of the compounds obtained near the bottom of the fractionating column are higher than those of the compounds obtained near the top of the column.
- **39** Biofuels are fuels obtained from biological sources such as plant materials and animal fats. Bioethanol is an example of a biofuel which can be made from plant carbohydrates.

Which of the following statements is true?

- A Bioethanol cannot be used directly or by blending with petrol.
- **B** Use of bioethanol will lead to more crowded highways.
- **C** Bioethanol is a non-renewable resource.
- **D** Bioethanol burns more cleanly in air than petroleum, producing less carbon (soot) and carbon monoxide.

40 Wine can deteriorate after a period of time, because of atmospheric oxidation. Which compound would be formed by the oxidation of the alcohol in the wine?



End of Paper

Colours of Some Common Metal Hydroxides

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

The Periodic Table of Elements																		
Group																		
1	2											13	14	15	16	17	18	
Key							1 H hydrogen 1										2 He ^{helium} 4	
3	4]	proton (atomic) number					4				5	6	7	8	9	10	1
Li	Be		atomic symbol									В	С	N	0	F	Ne	
lithium	beryllium		name									boron	carbon	nitrogen	oxygen	fluorine	neon	
7	9	-	relati	ive atomic i	mass							11	12	14	16	19	20	_
11	12											13	14	15	16	17	18	
Na	Mg											Al	Si	P	S	Cl	Ar	
sodium	magnesium	3	4	5	6	7	8	9	10	11	12	aluminium	silicon	phosphorus 21	sulfur	chlorine	argon	
10	24	21	22	23	24	25	26	27	28	20	30	21	20	33	34	35.0	40	-
K IS		21 Sc	Ti	23 V	Cr	Z5 Mn	Σ0 Ερ		20 Ni	23 Cu	Zn	Ga	Ge	Δε	54 50	Br	50 Kr	
potassium	calcium	scandium	titanium	v vanadium	chromium	mandanese	iron	cobalt	nickel	copper	zinc	gallium	germanium	arsenic	selenium	bromine	krypton	
39	40	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	1
Rb	Sr	Y	Zr	Nb	Мо	Тс	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Те	Ι	Xe	
rubidium	strontium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium	indium	tin	antimony	tellurium	iodine	xenon	
85	88	89	91	93	96	-	101	103	106	108	112	115	119	122	128	127	131	Ņ
55	56	57–71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	-
Cs	Ba	lanthanoids	Hf	Та	W	Re	Os	Ir	Pt	Au	Hg	Τl	Pb	Bi	Po	At	Rn	
caesium	barium		hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	thallium	lead	bismuth	polonium	astatine	radon	
133	137	00.400	170	101	104	100	190	192	195	197	201	204	207	209	-	_	-	_
87	88	89–103	104	105	106	107	108	109	110	111 D	112	113	114	115	116	117 T	118	
francium	Ra	actinoius	KI ruthorfordium	DD	Sg	BN	HS	IVIT	DS	Rg	Cn	INN	F l	IVIC	LV	IS	Og	
			- -		–			-	uannstautiun —	–	- copernicium	-	ilerovium —	-	-		uganessun —	
]
				= 0													1	
		57	58	59	60	61	62	63	64	65	66	67	68	69	70	/1		
lantha	anoids	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	I b	Dy	Ho	Er	Im	Yb	Lu		
		130	140	praseodymium 1 4 1		prometnium	samarium	europium 152	gadolinium	159	aysprosium	noimium 165	erbium 167	169	ytterbium 173	175		
		89	90	91	92	93	94	95	96	97	98	99	100	103	102	103	1	
		Ac	Th	Pa		Nn	Pu	Am	Cm	Bk	Cf	Fs	Fm	Md	No	l r		
actir	noids	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium		
		-	232	231	238		-	_	-	-	-	-	-	-	-	_		

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

The Avogadro constant, $L = 6.02 \text{ x } 10^{23} \text{ mol}^{-1}$