27 April 2024

香港考試及評核局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2024 年香港中學文憑考試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2024

物理　香港中學文憑考試　試卷一乙
PHYSICS　HKDSE　PAPER 1B

本評卷參考乃香港考試及評核局專為今年本科考試而編寫，供閱卷員參考之用。本評卷參考之使用，均受制於閱卷員有關之委任條款及閱卷員指引。特別是：

- 本局擁有並保留本評卷參考的所有財產權利(包括知識產權)。在未獲本局之書面批准下，閱卷員均不得複製、發表、透露、提供、使用或經營本評卷參考之全部或其部份。在遵守上述條款之情況下，本局有限 地容許閱卷員可在應屆香港中學文憑考試的考試成績公布後，將本評卷參考提供任教本科的教師參閱。

- 在任何情況下，均不得容許本評卷參考之全部或其部份落入學生手中。本局籲請各閱卷員/教師通力合作，堅守上述原則。

This marking scheme has been prepared by the Hong Kong Examinations and Assessment Authority for the reference of markers. The use of this marking scheme is subject to the relevant appointment terms and Instructions to Markers. In particular:

- The Authority retains all proprietary rights (including intellectual property rights) in this marking scheme. This marking scheme, whether in whole or in part, must not be copied, published, disclosed, made available, used or dealt in without the prior written approval of the Authority. Subject to compliance with the foregoing, a limited permission is granted to markers to share this marking scheme, after release of examination results of the current HKDSE examination, with teachers who are teaching the same subject.

- Under no circumstances should students be given access to this marking scheme or any part of it. The Authority is counting on the co-operation of markers/teachers in this regard.

©香港考試及評核局　保留版權
Hong Kong Examinations and Assessment Authority
All Rights Reserved 2024

HKDSE Physics

General Marking Instruction

1. It is very important that all markers should adhere as closely as possible to the marking scheme. In many cases, however, candidates may have obtained a correct answer by an alternative method not specified in the marking scheme. In general, a correct answer merits ***the answer mark*** allocated to that part, unless a particular method has been specified in the question. **Markers should be patient in marking alternative solutions not specified in the marking scheme.**

2. In the marking scheme, answer marks or 'A' marks are awarded for a correct numerical answer with a unit. **In case the same unit involved is given incorrectly for more than once in the same question, the 'A' marks thereafter can be awarded even for correct numerical answers without units.** If the answer should be in km, then cm and m are considered to be wrong units.

3. In a question consisting of several parts each depending on the previous parts, **marks for correct method or substitution** are awarded to steps or methods correctly deduced from previous answers, even if these answers are erroneous or for inserting values of appropriate physical quantities into an algebraic expression **irrespective of their order of magnitudes**. However, 'A' marks for the corresponding answers should **NOT** be awarded (unless otherwise specified).

4. For the convenience of markers, the marking scheme is written as detailed as possible. However, it is still likely that candidates would not present their solution in the same explicit manner, e.g. some steps would either be omitted or stated implicitly. In such cases, markers should exercise their discretion in marking candidates' work. In general, marks for a certain step should be awarded if candidates' solution indicated that the relevant concept/technique had been used.

5. In cases where a candidate answers more questions than required, the answers to all questions should be marked. However, the excess answer(s) receiving the lowest score(s) will be disregarded in the calculation of the final mark.

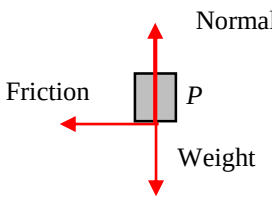
6. OSM (On-screen marking) marking symbols:

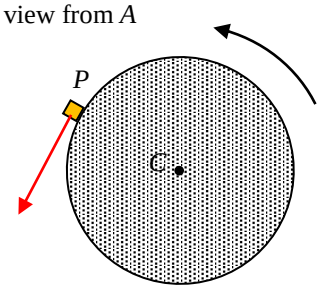
✓	correct point
×	wrong point
IG	ignore
⎓	point to highlight
〈_ _ _	incomplete answer
∧	missing point
文	entering text/comment

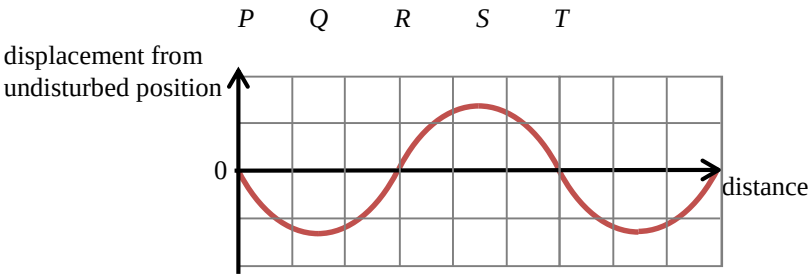
Solution	Marks	Remarks
1. (a) conduction OR radiation	1A 1	(b)
(b) Cannot, as the silvery surface of aluminum foil is a poor radiation absorber.	1A+1A 2	
(c) (i) The water droplets come from the moisture / water vapour in the air (surroundings).	1A 1	Complete Explanation: 1. poor radiation absorber 2. good radiation reflector
(ii) $E = (0.40 \times 10^{-3})(2.26 \times 10^{6})$ $= 904$ J	1M 1A 2	
2. (a) (i) $E_K = \frac{1}{2}\left(6.63\times10^{-26}\right)(500)^2$ $= 8.2875 \times 10^{-21}$ J $\approx 8.29 \times 10^{-21}$ J	1M 1A 2	Accept: $(8.29 \sim 8.30) \times 10^{-21}$ J
(ii) $E_K = \frac{3RT_0}{2N_A}$ $T_0 = \frac{2}{3}\left(\frac{8.29\times10^{-21}}{8.31}\right)(6.02\times10^{23})$ $= 400.247$ (K) ≈ 400 (K)	1M 1A 2	e.c.f. from (a)(i)
(b) As temperature remains at T_0, E_K remains unchanged / $c_{r.m.s.}$ depends on temperature, so $c_{r.m.s.}$ remain unchanged.	1A 1A 2	

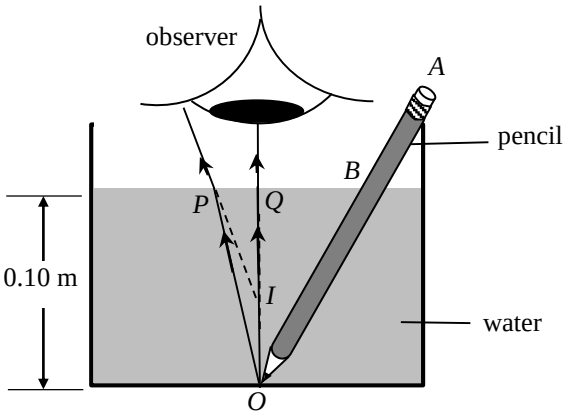
(b)

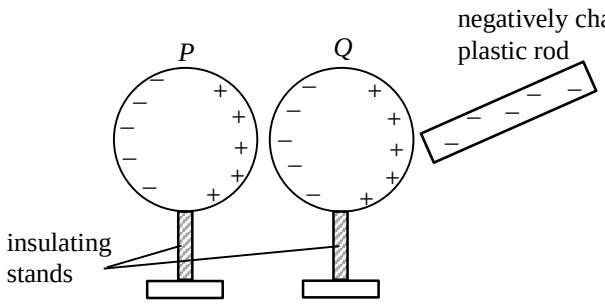
		Can	Cannot
Explan-ation	Complete	0	2
	Incomplete	0	1
	Wrong	0	0

Solution	Marks	Remarks
3. (a) By $Fs = \frac{1}{2}mv^2$, $0.30 \times 0.75 = \frac{1}{2}(0.20)\,v^2$ $v = 1.5$ m s^{-1}	1M 1A 2	Or $v^2 = u^2 + 2as$ and $F = ma$ $v^2 = 0^2 + 2(\frac{0.3}{0.2})(0.75)$
(b) 	2A 2	Accept: Normal force, gravity
(c) Height $= \frac{1}{2}gt^2 = \frac{1}{2}(9.81)(0.35)^2$ $= 0.6008625$ m ≈ 0.601 m	1M 1A 2	Accept: 0.60 m to 0.613 m

4.	(a)	(i)	$F = m\omega^2 r = 0.020 \times 6^2 \times 0.50$ $= 0.36$ N	1M 1A 2	
		(ii)	Top view from A 	1A 1	
	(b)	(i)	same angular speed	1A 1	
		(ii)	different / smaller magnitude of centripetal acceleration ($a_Q < a_P$) as Q takes a different / smaller radius ($r_Q < r_P$)	1A 1A 2	

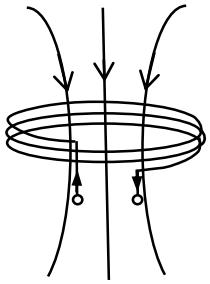
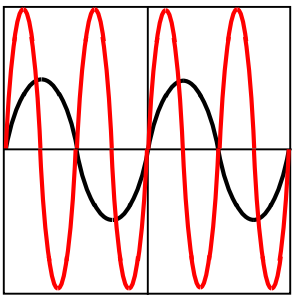
Solution	Marks	Remarks
5. (a)  	2A 2	Accept: 1A: Correct waveform (at least one wavelength) 1A: Correct labels of P to T
(b) (i) P / R / T	1A 1	
(ii) R	1A 1	
6. (a) Apply $d \sin\theta = m\lambda$, where θ is the deviation angle of the diffracted beam, m is order of diffraction maximum. $\tan\theta = \frac{x/2}{L} \Rightarrow \theta = 24.702430°$ or $\sin\theta = \frac{x/2}{\sqrt{L^2 + (x/2)^2}} = 0.417906$ $d = \frac{\lambda}{\sin\theta} = \frac{650 \times 10^{-9}}{0.418}$ $= 1.555375 \times 10^{-6}$ m $= 1.56$ μm	1M 1M 1A 3	Accept: 1.56 μm ~ 1.6 μm
(b) x will decrease as λ decreases, sin θ and θ will decrease.	1A 1A 2	Accept: as λ decreases, + less degree of diffraction

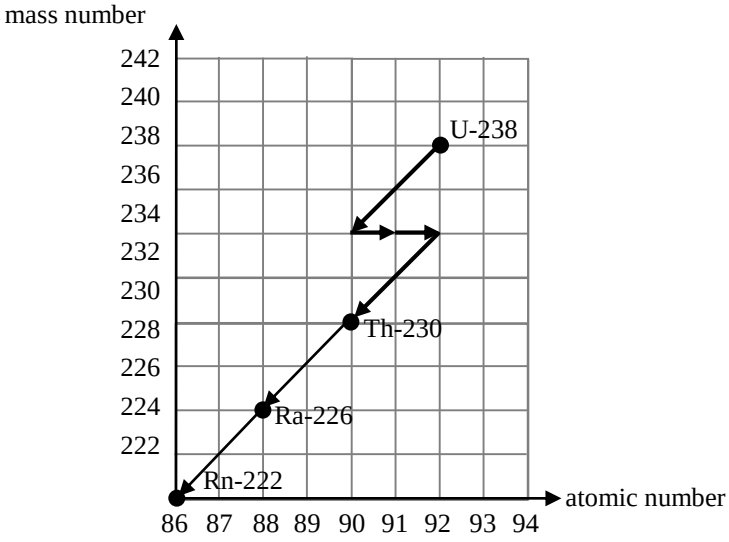
Solution	Marks	Remarks
7. (a) The speed of sound increases (linearly) with air temperature. OR The higher the air temperature, the greater is the speed of sound.	1A	NOT accept: The speed of sound is directly proportional to the air temperature.
	1	Accept: Positive relationship
(b) The air near the ground is cooler while the air layers higher above are relatively warmer,	1A	
the sound wave bends downward (towards the normal) as it travels slower when going from a higher temperature (upper) layer into a low temperature (lower) layer and vice versa, i.e. refraction occurs.	1A	Accept: Speed changes + refraction occurs / bend towards the normal
	2	
(c) (i) Speed ratio $\frac{3.00\times10^8}{337} = 8.90208\times10^5 \approx 8.90\times10^5$	1A	
	1	
(ii) The distance is given by 337×3.0	1M	e.c.f. from (c)(i) using incorrect sound speed
$= 1011$ m	1A	
	2	
8. (a) 	1A	Accept no arrows in the refracted rays
	1M	Image *I* formed by the two refracted rays.
	2	
(b) $1.33 = \frac{\sin r}{\sin 1.5^\circ}$	1M	
$r = 1.995175^\circ \approx 2.00^\circ$	1A	
	2	
(c) $\frac{h_1}{h} = \frac{\tan 1.5^\circ}{\tan 2.00^\circ} = 0.751681$ (or $\tan 1.5^\circ = \frac{PQ}{0.10}$ & $\tan 2^\circ = \frac{PQ}{h_1}$)	1M	e.c.f. from (b)
$\Rightarrow h_1 \approx 0.075$ m (i.e. 7.5 cm)	1A	Accept: $\frac{\text{real depth}}{\text{apparent depth}} = \frac{h}{h_1} = n$
	2	

Solution	Marks	Remarks
9. (a) 	2A	1A for accurate charge distribution 1A for balanced positive and negative charges on each sphere
	2	
(b) No, it remains unchanged as charging is through induction (without any contact or transfer of charges).	1A 1A	
	2	
(c) Hold / bring the unknown charged rod (assume positive) near <u>sphere *P*</u> without touching it. As *P* <u>is positively charged</u>, it will be repelled by the rod. (On the other hand, if *P* is attracted by the rod, the rod should carry negative charges.)	1A 1A	
	2	

Solution	Marks	Remarks
10. (a) 1. Use the protractor to measure or mark <u>a specific angle</u> at which the ball is released. Make sure the angle is measurable and recorded.	1A ✓	
2. Hold the ball at the marked angle and <u>release it from rest</u> with the string taut, allowing it to swing like a pendulum.	1A ✓	
3. <u>Measure</u> the angle at which the ball reaches its highest point and record the value <u>Or</u> <u>Observe</u> the angle at which the ball swings back to the original releasing position.	1A ✓	
4. <u>Compare</u> the measurements of the ball's <u>initial release angle to the angle it reaches on the opposite side</u> of the swing. (The angles equal implies total mechanical energy is conserved,)	1A ✓	
	4	
(b) (i) (I) The tension forces are vertical, the condition of no external forces along the colliding / horizontal direction is still fulfilled, the law can be applied. <u>Or</u> no net force acts on the system <u>Or</u> tensions are perpendicular to the direction of collision / no work is done on the sphere by the tension	1A	
	1	
(II) By conservation of total momentum, v_E is $2 \times 0.50 = 1.0$ m s^{-1}	1A	
However, the final total kinetic energy would then be $\frac{1}{2}(0.020)(1.0)^2 = 0.01\text{J} > \frac{1}{2}(2\times0.020)(0.50)^2 = 5\times10^{-3} = 0.005\text{J}$	1M	
which is greater than the total kinetic energy before collision, thus not possible.	1A	
	3	
(ii) Not perfectly elastic * as some kinetic energy is lost as sound / thermal energy, the total kinetic energy is not conserved.	1A 1A	*No mark will be awarded if the explanation is incorrect.
	2	

Solution	Marks	Remarks
11. (a) As the foil becomes longer / l increases while its cross-sectional area becomes smaller / A decreases due to decrease in width w, its resistance would increase according to $R = \frac{\rho l}{A}$.	1A 1A 2	
(b) (i) $V_{in} = I_1(R_1 + R_2)$	1A 1	
(ii) Before: $\frac{V_{out}}{V_{in}} = \frac{R_4}{R_3 + R_4} - \frac{R_2}{R_1 + R_2}$ $= \frac{500}{470+500} - \frac{470}{470+470} = 0.0154639$ After: $\frac{V_{out}}{V_{in}} = \frac{R_4}{R_3 + R_4} - \frac{R_2}{R_1 + R_2}$ $= \frac{501}{470+501} - \frac{470}{470+470} = 0.0159629$ Thus $\frac{V_{out}}{V_{in}}$ increases 3.22687% ≈ 3.23%.	1M 1A 2	1M if the correct values are accurately substituted in both equations.
(iii) (I) crack ① (II) along AB	1A 1A 2	

Solution	Marks	Remarks
12. (a) 	2A	1A for correct direction 1A for correct field pattern
	2	
(b) (i) The a.c. flowing in transmitter coil *T* generates a changing magnetic field, thus by electromagnetic induction an induced e.m.f. is produced in receiver coil *R* to oppose the changing magnetic flux experienced by it.	1A 1A	
	2	
(ii) CRO display 	2A	1A for correct frequency 1A for correct amplitude
	2	
(c) If the back cover is metallic, eddy currents will be produced (by induction), loss of energy results Or magnetic field / flux is blocked by the metal case and thus making wireless charging impossible. Or Non-metallic materials such as glass are insulators, and no eddy currents are produced. As a result energy loss will be minimized / the magnetic field can pass through the back cover easily.	1A 1A 1A 1A	
	2	

Solution	Marks	Remarks
13. (a) (i) $k = \frac{\ln 2}{t_{1/2}}$		
$= \frac{\ln 2}{3.82 \times 24 \times 3600}$	1M	
$= 2.1001405 \times 10^{-6}\ s^{-1} \approx 2.10 \times 10^{-6}\ (s^{-1})$	1A	
	2	
(ii) $A = kN$		
$N = \frac{48}{2.10 \times 10^{-6}}$	1M	e.c.f. from (a)(i)
$= 2.285561 \times 10^{7} \approx 2.29 \times 10^{7}$	1A	Accept: $(2.28 \sim 2.3) \times 10^{7}$
	2	
(iii) As radon is a gas that can be inhaled into the lungs of human,	1A	
the relatively strong ionizing power of α particles emitted by decaying radon / radioactive gas might affect the organs / cells nearby.	1A	
	2	
(b) 	2A	1st A: 1 correct α or β 2nd A: all correct Deduct 1 A for no / missing arrows
	2	