

Paper 1 Section A

Question No.	Key	Question No.	Key
1.	A (59)	26.	D (33)
2.	B (39)	27.	B (48)
3.	C (45)	28.	A (77)
4.	A (78)	29.	*
5.	D (18)	30.	A (33)
6.	D (57)	31.	D (53)
7.	C (80)	32.	A (77)
8.	C (48)	33.	C (66)
9.	A (25)		
10.	C (51)		
11.	A (49)		
12.	A (54)		
13.	B (45)		
14.	B (58)		
15.	B (79)		
16.	C (74)		
17.	B (48)		
18.	D (49)		
19.	D (62)		
20.	D (59)		
21.	A (45)		
22.	C (41)		
23.	C (71)		
24.	D (30)		
25.	B (75)		

* This item was deleted.

Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.

General note on item deletion

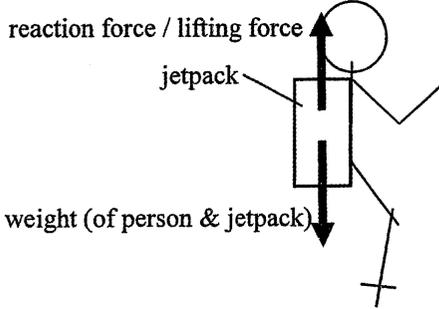
It is normal for the HKEAA to delete a small number of items from its multiple-choice question papers if they prove unsatisfactory. In practice, there are a number of reasons why this is considered necessary. By far the most common reason for deleting an item is that the item fails to discriminate between weak and able candidates – in other words, the majority of the candidates involved had to rely on guesswork in answering that question. If such an item is retained, the measurement process is rendered less effective. Where items have been deleted in the live papers, they are still included in this series of publications. They are indicated as deleted items. Such items may be discussed in the corresponding examination reports.

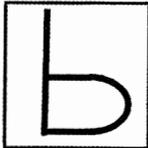
Paper 1 Section B

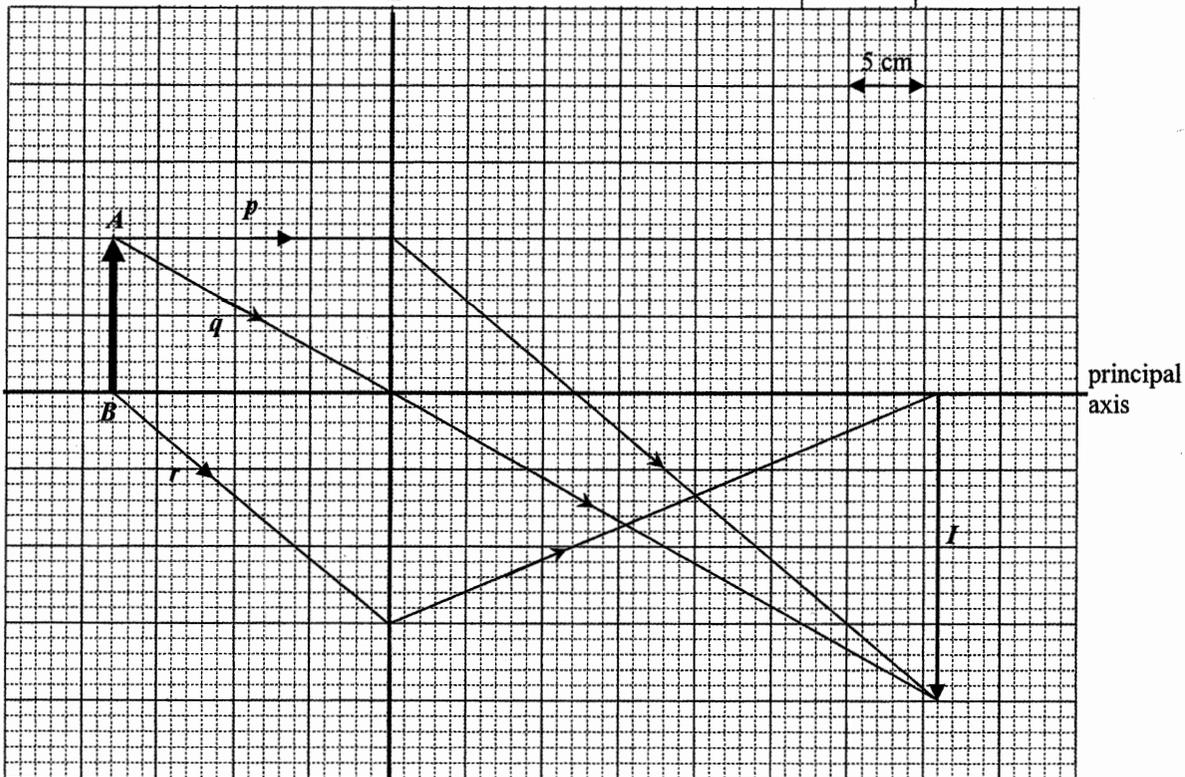
Solution	Marks	Remarks
<p>1. (a) - Put the sphere into the water bath for a few minutes - Put / transfer the sphere into the polystyrene cup (of water) - Measure the final / maximum temperature T_f of the water with a thermometer</p> $0.80 \times c_b \times (80 - T_f) = 0.50 \times 4200 \times (T_f - T_0)$ $c_b = 2625 \times \frac{T_f - T_0}{80 - T_f} \text{ (J kg}^{-1} \text{ }^\circ\text{C}^{-1}\text{)}$ <p>Precautions: - Dry the sphere with the towel quickly before putting it into the cup - Make sure the sphere is fully immersed in water - Stir the water thoroughly</p>	<p>1A 1A 1A 1A 1A 1A 1A</p>	
	6	
<p>(b) Thermal energy / heat is lost during the transfer / drying of the sphere</p> <p>Or Thermal energy / heat absorbed by thermometer, stirrer or cup</p> <p>Or The temperature of the sphere is higher than T_f when this final temperature is measured (i.e. T_f not reaching its maximum)</p>	<p>1A 1A 1A</p>	
<p>Thus temperature rise of water in the cup is lower than it should be.</p>	1A	
	2	

Solution	Marks	Remarks
2. (a) $pV = nRT$ $(1.0 \times 10^5)(6.0 \times 10^{-5}) = n(8.31)(273 + 25)$ $n = 2.422891 \times 10^{-3} \text{ moles} \approx 2.42 \times 10^{-3} \text{ moles}$ No. of molecules = nN_A $= n \times 6.02 \times 10^{23}$ $= 1.458581 \times 10^{21} \approx 1.46 \times 10^{21}$	1M 1M 1A	
<div style="border: 1px solid black; padding: 5px;"> <i>Alternative method:</i> $pV = nRT = \left(\frac{N}{N_A}\right)RT \Rightarrow N = \left(\frac{pV}{RT}\right)N_A$ $N = \frac{(1.0 \times 10^5)(6.0 \times 10^{-5})}{(8.31)(273 + 25)} \times (6.02 \times 10^{23})$ $= 1.458581 \times 10^{21} \approx 1.46 \times 10^{21}$ </div>	1M 1M 1A	
(b) (i) <ul style="list-style-type: none"> - The piston should be pushed or pulled slowly / lightly. - Avoid taking readings immediately after moving the piston. - The syringe should not be grasped by hand too long (when the piston is pushed in or pulled out). 	3 1A 1A 1A 1	Any ONE
(ii) V_0 - volume of gas trapped in the rubber tubing / space connecting the pressure sensor and syringe.	1A 1	
(iii) <div style="text-align: center; margin-top: 10px;"> </div>	1A 1A 2	NO mark for a curve

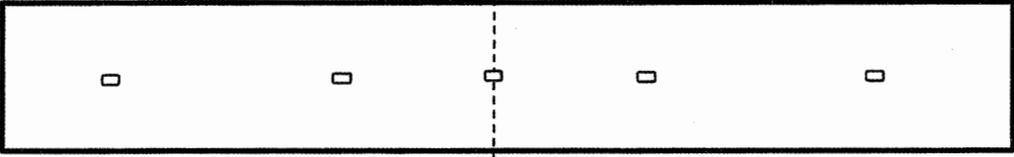
Solution	Marks	Remarks
3. (a) $a = \frac{6-0}{2-0}$ $= 3 \text{ m s}^{-2}$ (downwards)	1M 1A 2	
(b) A: 395 N B: 569 N C: 685 N In stage B, balance reading = weight (Newton's 1 st law), $mg = m \times 9.81 \text{ m s}^{-2} = 569 \text{ N}$ $m = 58.0 \text{ kg}$	1A 1M 1A	For $g = 10 \text{ m s}^{-2}$, $m = 56.9 \text{ kg}$
Or In stage A, according to Newton's 2 nd law $(569 - 395) \text{ N} = ma = m(3 \text{ m s}^{-2})$ $m = 58.0 \text{ kg}$	1M 1A	
(c) (i) For stage C, by Newton's 2 nd law, $F = ma$ $(569 - 685) \text{ N} = (58.0 \text{ kg}) a$ $a = -2 \text{ m s}^{-2}$ Thus, $a = \frac{0-6}{T-12} = -2 \text{ m s}^{-2}$ $T = 15 \text{ s}$	3 1M 1M	For $g = 10 \text{ m s}^{-2}$, $m = 56.9 \text{ kg}$, $a = -2.04 \text{ m s}^{-2}$
(ii) Height \approx displacement of lift = area under graph $= \frac{(12-2)+15}{2} \times 6$ $= 75 \text{ m}$	2 1M 1A 2	

Solution	Marks	Remarks
<p>4. (a) According to Newton's second law of motion, a (net) force acts on the water so as to change its momentum. (Or magnitude of the force equals the rate of change of momentum of water).</p> <p>According to Newton's third law of motion, a force acting downwards on the ejecting water (by the jetpack), the water exerts a reaction (equal but upward / opposite) on the jetpack / person as well.</p>	<p>1A</p> <p>1A</p> <p>1A</p> <p>3</p>	
<p>(b)</p> 	<p>1A</p> <p>1</p>	
<p>(c) (i)</p> $F = \frac{\Delta p}{\Delta t} = \frac{\Delta m}{\Delta t} \times (\vec{v} - \vec{u})$ $\frac{\Delta m}{\Delta t} \times (10 - (-10)) \text{ m s}^{-1} = 1000 \text{ N}$ $\frac{\Delta m}{\Delta t} = 50 \text{ (kg s}^{-1}\text{)}$	<p>1M</p> <p>1A</p> <p>2</p>	<p>Accept using kg as the unit.</p>
<p>(ii)</p> $\left(\frac{\Delta m}{\Delta t}\right)gh + \frac{1}{2}\left(\frac{\Delta m}{\Delta t}\right)v^2$ $= (50 \text{ kg s}^{-1})(9.81 \text{ m s}^{-2})(7.5 \text{ m}) + \frac{1}{2}(50 \text{ kg s}^{-1}) \times (10 \text{ m s}^{-1})^2$ $= 6178.75 \text{ W or } 6.17875 \text{ kW}$	<p>1M</p> <p>1M</p> <p>1A</p> <p>3</p>	<p>Accept using m for $\left(\frac{\Delta m}{\Delta t}\right)$</p> <p>For $g = 10 \text{ m s}^{-2}$, $3750 \text{ W} + 2500 \text{ W} = 6250 \text{ W}$</p>
<p>(d) The same as the same lifting force / (water) jet speed is needed.</p>	<p>1A</p> <p>1A</p> <p>2</p>	

Solution	Marks	Remarks
5. (a) (i) Convex (lens) Only convex lens forms real image (which can be captured by a screen) <u>Or</u> Concave lens always forms virtual image (which cannot be captured by a screen). <u>Or</u> The image is formed on the other side of the lens.	1A 1A 1A 1A	
(ii)  opaque screen	2 1A	
(b) (i) Image distance $v = 54 - 18 = 36$ cm ($D = 54$ cm) Magnification = $\frac{v}{u} = \frac{36}{18} = 2$	1A 1M/1A	
	2	



(ii) Image I of AB Rays p and q Ray r	1M 1M 1M	1M for correct position of I
(iii) Focal length = 12 ± 0.5 cm	3 1M/1A	
(iv) Move the lens 18 cm farther away from the object. <u>Or</u> move the lens 18 cm closer to / towards the screen. Height ratio = 1 : 4.	1 1M 1A	
	2	

Solution		Marks	Remarks
6. (a) (i)	$\Delta y = \frac{\lambda D}{a}$ $\frac{(4.0 - 0) \times 10^{-2}}{10} = \frac{\lambda(1.8)}{0.3 \times 10^{-3}}$ $\lambda = 6.666667 \times 10^{-7} \text{ m}$ $\approx 6.67 \times 10^{-7} \text{ m or } 667 \text{ nm}$	1M+1M 1A	Explanation in terms of formula $\lambda = \Delta y \frac{a}{D}$ is NOT accepted as a is the slit separation given, which is fixed.
	(ii) To ensure that the light through the 2 slits diffracts enough to interfere / overlap.	1A 1A	
		2	
(b) (i)	$d \sin \theta = m\lambda$ $\frac{10^{-3}}{500} \sin \theta = 6.67 \times 10^{-7} \text{ m}$ $\theta = 19.471221^\circ \approx 19.47^\circ$ <p>Separation between central and first-order bright spot $= 1.8 \tan 19.47^\circ$ $= 0.636396 \text{ m} \approx 0.636 \text{ m}$</p>	1M 1A	
		3	
		3	
(ii)	<p style="text-align: center;">centre of the pattern</p> 	1A 1A	symmetry about the central bright spot (2 nd order shown) separation between 2 nd and 1 st -order bright spots is larger
	2		

Solution	Marks	Remarks
<p>7. (a) (i) $R = 10 \text{ k}\Omega$ (circuit I)</p> $V = \frac{\left(\frac{1}{10 \text{ k}\Omega} + \frac{1}{10 \text{ k}\Omega}\right)^{-1}}{10 \text{ k}\Omega + \left(\frac{1}{10 \text{ k}\Omega} + \frac{1}{10 \text{ k}\Omega}\right)^{-1}} \times 6 \text{ V}$ $= 2 \text{ V}$ <p>$R = 100 \Omega$ (circuit II)</p> $V = \frac{\left(\frac{1}{100 \Omega} + \frac{1}{10 \text{ k}\Omega}\right)^{-1}}{100 \Omega + \left(\frac{1}{100 \Omega} + \frac{1}{10 \text{ k}\Omega}\right)^{-1}} \times 6 \text{ V}$ $= 2.985 \text{ V}$ <p>(ii) Resistance of circuit / that part of circuit would be lowered / altered significantly when introducing the voltmeter (i.e. loading effect).</p> <div style="border: 1px solid black; padding: 2px;"> <p>Or The resistance of the voltmeter is comparable to the resistance of resistor R.</p> </div> <p>Resistance of voltmeter should be much higher than the resistance of the part of the circuit under study.</p>	<p>1M</p> <p>1A</p> <p>1A</p> <p>3</p> <p>1A</p> <p>1A</p> <p>2</p>	<p>1M for appropriate method in calculating voltage</p> <p>Note: 100Ω and $10 \text{ k}\Omega$ in parallel $\approx 99.0099 \Omega$ Accept stating that V slightly $< 3 \text{ V}$</p>
<p>(b) (i) V_m does NOT give the true voltage for the resistor. $R_m = R_A + R$</p> <p>(ii) For circuit III $R_m = R + R_A = 10 + 1 = 11 \Omega$ percentage error $= \frac{1 \Omega}{10 \Omega} \times 100 \%$ $= 10\%$</p>	<p>1A</p> <p>1A</p> <p>2</p> <p>1M</p> <p>1A</p> <p>2</p>	

Solution	Marks	Remarks
8. (a) (i) - the air loses its insulating properties	1A	
<u>Or</u> electrons or ions can pass through the air (between clouds and Earth or between clouds and clouds)	1A	
	1	
(ii) $E = \frac{V}{d}$	1M	
$V = E d = (3 \times 10^5) \times 2000$	1A	
$= 6 \times 10^8 \text{ V}$	2	
(b) (i) magnetic field into paper (due to upward lightning current)	1A	
$B = \frac{\mu_0 I}{2\pi r}$	1M	
$= \frac{4\pi \times 10^{-7} \times 30000}{2\pi \times 1500}$	1A	
$= 4 \times 10^{-6} \text{ T}$	3	
(ii) When the lightning current is increasing, the induced current flows in the anticlockwise direction so as to oppose the increasing magnetic field (into paper). After reaching maximum, the lightning current is decreasing, the induced current flows in the clockwise / opposite direction.	1A 1A 1A	
	3	
(iii) Electric field (in the atmosphere). E-field increases / builds up (to threshold) before lightning happens	1A 1A	
<u>Or</u> Lightning current and magnetic field only exist during lightning.	1A	
	2	

Solution	Marks	Remarks
9. (a) $(4)n_{\alpha} = 238 - 206 \Rightarrow n_{\alpha} = 8$ $(2)n_{\alpha} + (-1)n_{\beta} = 92 - 82 \Rightarrow n_{\beta} = 6$	1A 1A	
	2	
(b) (i) $N = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}}$ $\frac{3}{5} = \left(\frac{1}{2}\right)^{t/4.5 \times 10^9 \text{ yr}}$	1M	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Or $N = N_0 e^{-\lambda t}$ and $\lambda = \frac{\ln 2}{T_{1/2}}$ </div>	1M	
$\therefore t = 3.316 \times 10^9 \text{ years} \approx 3.3 \times 10^9 \text{ years}$	1A 2	
(ii) Answer in (i) is an underestimate. The original number of U-238 atoms should be greater. \therefore the ratio $\frac{\text{present number of U-238 atoms}}{\text{original number of U-238 atoms}} = \frac{N_t}{N_0}$ is in fact smaller (than $\frac{3}{5}$), thus longer time should have been elapsed.	1A 1A	Accept 'more U decayed'.
	2	
(iii) <div style="text-align: center; margin-top: 10px;"> </div>	2A 2	