Paper 1 (MCQ)

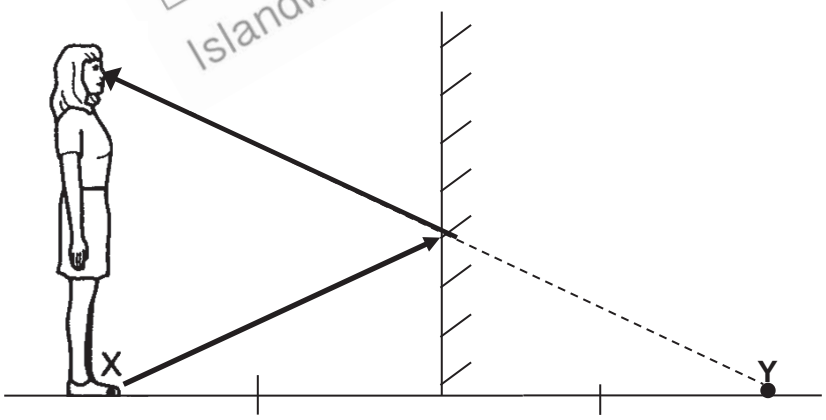
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
A	**C**	**D**	**B**	**C**	**D**	**C**	**A**	**B**	**C**
E	E	E	M	H	E	H	M	E	E

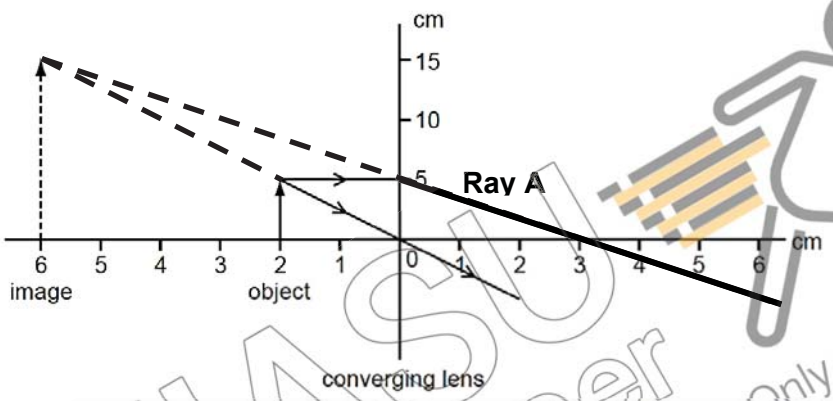
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
D	**B**	**C**	**B**	**A**	**B**	**C**	**A**	**B**	**D**
E	E	M	E	H	E	M	H	M	M

H	M	E
4	6	10
20%	30%	50%

Section A

Qns	Answers	Marks	Remarks
1			
a	**5** complete **waves** produced in **one second**.	1[E]	
b	To minimize the error due to **human reaction time** on the timings.	1[M]	
c	<t> = (3.93+4.07+3.55+3.99) / 4 = 3.085 s T = 3.085 / 10 = 0.309 s	1[E] 1[E]	
d	The period decreases.	1[H]	
2			
a	When the speed is constant, the **resultant force is zero** since there is **no acceleration**. Hence, P is **equal** to F.	1[M] 1[M]	
b	$a = F_N / m$ $= - 90.0 / 7$ $= - 12.9\ m/s^2$ Deceleration = $12.9\ m/s^2$	1[E] 1[M] 1[M]	

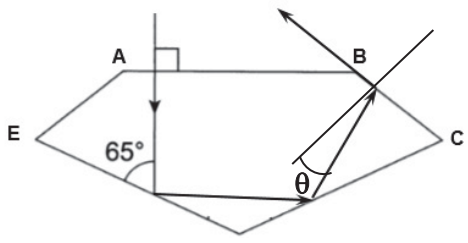
3			
a	$A = 5.00 \times 10^{-4}\ m^2$	1 [H]	
	$p = F/A$		
	$= 45.0 / (5.00 \times 10^{-4})$	1 [E]	Allow ecf if did not convert to m^2
	$= 90\,000$ Pa	1 [E]	
b	The **pressure increases**. From the formula **p = F/A**, when the **weight remains the same**, the pressure will increases if the **base area decreases**.	1 [H] 1 [H]	
4			
a	$W = mg$ $= (45 \times 10) \times 8$ $= 3\,600$ N	1 [E] 1 [E]	Award 1 mark if student calculate 1 cylindrical shape.
bi	$\rho = m / V$ $= 45.0 / 0.120$ $= 375\ kg/m^3$	1 [E] 1 [E]	
bii	The raft will **float** on water as its **density is lower** than the density of water.	1 [M]	
5			
a		3 [M]	Incident ray – 1 mark Reflected ray – 1 mark Image Y (equal distance) – 1 mark No/wrong arrow or no dotted line – deduct 1 mark
b	The distance **decreases by 2.00 m**.	1 [H]	

6			
a	Any two. It is a transverse wave. It can travel through vacuum. It travel at a speed of $3x10^8$ m/s in vacuum.	2 [E]	
b	X-ray or gamma rays X-ray – radiography Gamma rays – treat cancer	1 [E] 1 [E]	
7			
a	Focal length = 3.00 cm	1 [E]	
		2 [H]	Ray A – 1 mark Virtual ray – 1 mark
b	2 x f = 2 x 3 = 6.00 cm	1 [M]	
c	The image will be **shorter.**	1 [H]	
8			
a	Wavelength = 16/2 = 8.00 cm Amplitude = 2.00 mm	1 [M] 1 [E]	
b	f = 1 / T = 1 / 0.50 = 2.00 Hz	 1 [M] 1 [E]	
c	v = fλ = 2.00 x 0.08 = 0.160 Hz	 1 [E] 1 [E]	Allow ecf Award 1 mark if student use 8 cm instead.

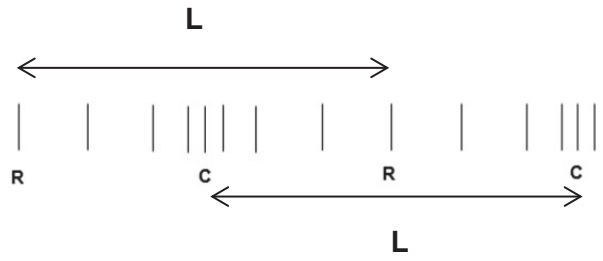
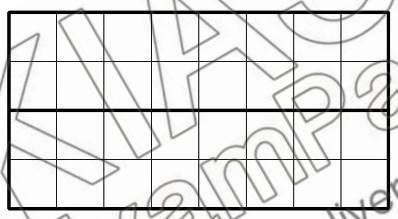
9			
a	Weight (gravitational force) and air resistance	2 [E]	
b	10.0 m/s^2	1 [M]	
ci	decreasing acceleration	1 [M]	
cii	constant speed or zero acceleration or terminal velocity	1 [E]	
d	t = 60.0 s	1 [E]	

H	M	E
8	14	23
17.8%	31.1%	51.1%

Section B

10			
ai	The angle of incidence is **0** °. Or incident **normally**.	1 [E]	
aii	i = 90 – 65 = 25 °	1 [E]	
aiii	n = sin i / sin r r = $\sin^{-1}$(n x sin i) = $\sin^{-1}$(1.60 x sin 25) = 42.5 °	1 [M] 1 [M]	Allow ecf
bi	c = $\sin^{-1}$(1 / n) = $\sin^{-1}$ (1 / 2.40) = 24.6 °	1 [M] 1 [M]	
bii		1 [H]	

biii	The angle of **<u>incidence</u>** at boundary **DE** is **<u>greater than</u>** the **<u>critical angle</u>** and the ray travels from an **<u>optically denser</u>** medium to an **<u>optically less dense</u>** medium.	1 [E] 1 [E]	
biv	Due the smaller critical angle, a light ray will undergo **<u>more total internal reflection</u>** in diamond.	1[H]	
	<table><tr><td>H</td><td>M</td><td>E</td></tr><tr><td>2</td><td>4</td><td>4</td></tr><tr><td>20%</td><td>40%</td><td>40%</td></tr></table>		
11			
a	speed / ms^{-1}  	1 [E] 2 [M]	1 mark for each correct section Deduct 1 m for incorrect timing.
bi	a = (v – u) / t = (0 – 22.5) / 8 = - 2.81 m/s^2 deceleration = 2.81 m/s^2	1 [E] 1 [M] 1 [M]	
bii	d = area under v-t graph = (15x4) + (15x5) + (1/2 x5x7.5) + (1/2 x 8 x 22.5) = 244 m	1 [H] 1 [H]	
biii	<v> = d/t = 244 / 17 = 14.4 m/s	1 [E] 1 [E]	Allow ecf
	<table><tr><td>H</td><td>M</td><td>E</td></tr><tr><td>2</td><td>4</td><td>4</td></tr><tr><td>20%</td><td>40%</td><td>40%</td></tr></table>		

12			
ai	Layers of air particles **<u>vibrate</u>** and **<u>pushed together</u>** or **<u>stretched apart</u>**, forming a series of **<u>compressions and rarefactions</u>**. The sound wave then **<u>travels parallel</u>** to the **<u>direction of vibrations</u>** of particles.	1 [H] 1 [E] 1 [H]	
aii		1 [E]	Either C – C Or R - R
aiii	f = v / λ = 330 / 0.084 = 3930 Hz	1 [E] 1 [M]	Allow ecf Award 1 mark if student did not convert to m.
bi		1 [E] 1[M]	Correct amplitude – 1 mark Correct frequency – 1 mark
bii	The **<u>pitch</u>** of X is **<u>lower</u>** than Y as its **<u>frequency is lower</u>** than Y. X is **<u>louder</u>** than Y as its **<u>amplitude is higher</u>** than Y.	1[E] 1[M]	
	<table><tr><td>H</td><td>M</td><td>E</td></tr><tr><td>2</td><td>3</td><td>5</td></tr><tr><td>20%</td><td>30%</td><td>50%</td></tr></table>		