

MARK SCHEME - WAVES + OPTICS

7	(a)	(i)	x-rays or gamma rays	B1	
		(ii)	infra red or radio	B1	2
	(b)		$f = v/\lambda$ or $3 \times 10^8 / 1 \times 10^{-12}$ $= 3 \times 10^{20}$ Hz	C1 A1	2
	(c)		3×10^8 m/s	1	1
					[5]

6	(a)	3 more roughly circular	B1	
		all drawn clearly circular, stop (well) clear of barrier and centred on slit	B1	
		wavelength constant throughout, both sides of barrier	B1	3
	(b)	wavelength – speed/frequency in any form	C1	
		values substituted correctly	C1	
		answer 6×10 m	A1	3
				[6]

6	(a)	(i)	incident ray, refracted ray and normal drawn all correct and meeting at a point	C1 A1	
		(ii)	angle of incidence and refraction correctly identified	B1	
		(iii)	values correct within agreed limits	B1	4
	(b)		use of $\sin i / \sin r$ correct substitution from candidates values value correct within agreed limits from candidate's values	C1 C1 A1	3
					[7]

7	(a)		C,R,C,R,C,R marked (or v.v.) along XY	B1	1
	(b)	(i)	Above normal / high air pressure or particles close together	B1	
		(ii)	Below normal / low pressure or particles further apart	B1	2
	(c)		Oscillation / vibration of particles / molecules (or particles / molecules move to and fro) Oscillation is along XY	B1 B1	2
	(d)		Time = distance / speed or (2x) 50/340 Time = 0.29 s	C1 A1	2

7	(a) (i)	two approximately correct reflections evidence of projecting back to image or use of equal distance from the mirror, object and image	B1 B1	[4]
	(ii)	virtual any one of upright, same size, same distance from mirror	B1 B1	
	(b) (i)	ray 1 correct ray 2 correct image correctly located	B1 B1 B1	
	(ii)	eye symbol to right of lens	B1	
				[4] Total [8]

6	(a)	along normal or angle $i = 0$ so angle $r = 0$	B1	1
	(b)	speed reduced, wavelength reduced, frequency unchanged any two correct scores one mark third correct scores second mark	B1 B1	2
	(c)	reflected at 30° refracted at $> 30^\circ$	B1 B1	2
	(d)	$\sin 30^\circ / \sin r = 0.67$ $\sin r = \sin 30^\circ / 0.67$ $r = 48^\circ$	C1 C1 A1	3 [8]