Answers prepared by Leong Yee Pak

Section A

Progressive waves
Transverse and longitudinal waves

***1 June 02 P1 Q27 B**

****2 Nov 02 P1 Q26** D

****3 Nov 02 P1 Q27** D Intensity $\propto$ (amplitude)^2. $I = kA^2$. For wave 1: $3.0 = ka^2$ ……..(1).
For wave 2: $I_2 = k(2a)^2$ ....(2). Solve the 2 equations

****4 Nov 03 P1 Q23** A

***5 Nov 03 P1 Q25** D All progressive waves transfer energy and all transverse waves can be polarized

***6 June 04 P1 Q24** B Only transverse wave can be polarized.

****7 June 04 P1 Q25** A Sketch the new wave profile a short instant later to deduce the answer

*****8 June 04 P1 Q26** B Intensity $I = kA^2$. Also intensity $I = E / (St) = (E/t)/S = E/S$
Hence $kA^2 = E/S$, and $E = kA^2S$. $E_2 = k(2A)^2 . ½ S = 2 kA^2S$

***9 Nov 04 P1 Q24** D

****10 Nov 04 P1 Q26** C Intensity $\propto$ (amplitude)^2. $I = kA^2$. For wave X: $I_X = k20^2$ ……..(1).
For wave Y: $I_Y = k\ 5^2$ ……………..(2)

****11 June 05 P1 Q25** B Intensity $\propto$ (amplitude)^2. For first position $I = kA^2$ ……………..(1) For second position, $2I = kA_2^2$ ……………..(2)

****12 Nov 05 P1 Q23** B

*****13 Nov 05 P1 Q24** Given, intensity $I = k\ A^2\ f^2$. For wave P: $I_p = k\ x_0^2 . f_0$
For wave Q: $I_Q = k\ (2x_0)^2 . ½\ f_0$. Solve the 2 equations

****14 Nov 05 P1 Q25** C Apply $v = f\lambda$. For refraction, frequency remains constant

****15 June 06 P1 Q24** B Period $T = \dfrac{1}{f}$. When f is halved, T doubled.

****16 June 06 P1 Q25** B Use $v = f\lambda$ to find λ. For distance λ, phase difference = 2π rad. Hence taking ratio, for x = 0.17 m, what is ϕ?

***17 Nov 06 P1 Q24** B

****18 Nov 06 Q25** C For distance λ, phase difference = 2π rad. Use ratio, for distance 1.5 λ, what is the phase difference?

****19 June 07 P1 Q22** A Intensity $\propto$ (amplitude)^2

*****20 June 07 P1 Q23** D At the extreme ends of an oscillation, , the object stops momentarily and accelerates in the opposite direction. Its acceleration is maximum.

****21 Nov 07 P1 Q21** B Intensity $\propto$ (amplitude)^2

*****22 Nov 07 P1 Q23** B frequency = 8.0 / 50 = 0.16 Hz. Max v = (2π x 2 x 0.16). Max k.e. = ½ x (2.0 x 10^{-3}) x (2π x 2 x 0.16)^2

****23 June 08 P1 Q25** B

*****24 June 08 P1 Q26** D At P, intensity = I. At Q, intensity = $\frac{1}{4}I$.

At P, I = k x 8.0^2. At Q, $\frac{1}{4}I = k\,A_Q^2$

****25 Nov 08 P1 Q24** D Intensity $\propto$(amplitude)^2. Frequency f = 1/T

****26 Nov 08 P1 Q26** A Intensity $\propto$(amplitude)^2

Polarisation

Determination of frequency, wavelength and velocity

***1 June 03 P1 Q23** B

***2 Nov 05 P1 Q22** D

***3 June 06 P1 Q23** A

***4 June 07 P1 Q21** C

****5 June 02 P1 Q26** B f = N/t. N = 2.5 cycles. t = 10 x 2.0 ms = 20 x 10^{-3} s

****6 June 03 P1 Q26** B f = N/t. N = 2.0 cycles. t = 8 x 2.5 ms = 20 x 10^{-3} s

Electromagnetic Waves

****1 June 02 P1 Q25** C velocity of all e.m. waves = velocity of light in vacuum

****2 Nov 02 P1 Q25** A Wavelength of microwave = 1 mm to 1 m

****3 June 03 P1 Q25** C Velocity of all e.m. waves in vacuum = c. c = fλ. $\lambda \propto \frac{1}{f}$. When f is halved, λ is doubled

****4 June 04 P1Q27** C wavelength of infra-red = 8 x 10^{-7} m to 1 mm

*** 5 June 05 P1 Q23** A

*****6 June 05 P1 Q24** B

****7 June 07 P1 Q24** D

****8 Nov 07 P1 Q22** B

***9 Nov 08 P1 Q25** B

****10 June 09 P1 Q 23** D

Section B

1 Nov 03 P2 Q25

(a)(i) 1. 0.4 mm
2. $\lambda = 15/2 = 7.5$ cm
3. $f = N/t = 2 / (0.4 \times 10^{-3}) =$
4. Speed $v = f\lambda$ =
(ii) $f = 1/T$. when frequency is halved, period is doubled.

2 June 04 P2 Q2

2 **(a)**	**(i)**	λ = 0.6 m	B1	
	(ii)	frequency (= v/λ) = 330/0.60 = 550 Hz *(use of c = 3 x 10^8 ms^{-1} scores no marks)*	C1 A1	**[3]**
(b)		amplitude shown as greater than *a* but less than 2*a* and constant correct phase *(wave to be at least three half-periods, otherwise -1 overall)*	B1 B1	**[2]**
		Total		**[5]**

3 Nov 04 P2 Q2

2 **(a)** all same speed in a vacuum (allow medium)/all travel in a vacuum (1)

transverse/can be polarised (1)

undergo diffraction/interference/superposition (1)

can be reflected/refracted (1)

show properties of particles (1)

oscillating electric and magnetic fields (1)

transfer energy/progressive (1)

not affected by electric and magnetic fields (1)

(allow any three, 1 each) **B3** **[3]**

(b) 495 nm = 495 x 10^{-9} m **C1**

number = 1/(495 x 10^{-9}) = 2.02 x 10^{6} **A1 [2]**

(allow 2 or more significant figures)

(c) **(i)** allow $10^{-7} \rightarrow 10^{-11}$ m **B1**

(ii) allow $10^{-3} \rightarrow 10^{-6}$ m **B1 [2]**