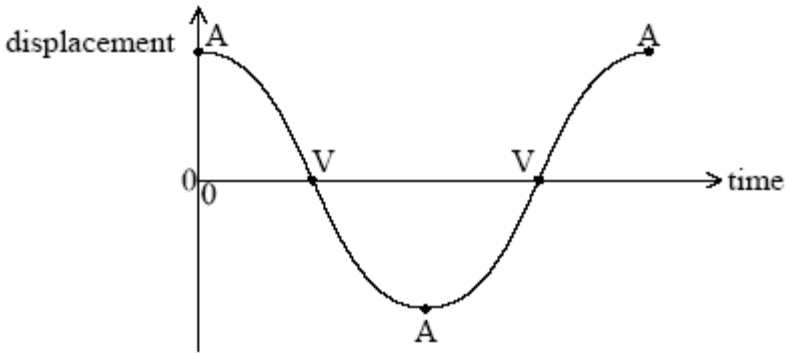
CHAPTER 9 TEST REVIEW -- MARKSCHEME

1.	A	**3.**	D	**5.**	A	**7.**	A	**9.**	A
2.	C	**4.**	A	**6.**	A	**8.**	D	**10.**	D

11. (a) (i) one A correctly shown; 1

(ii) one V correctly shown; 1



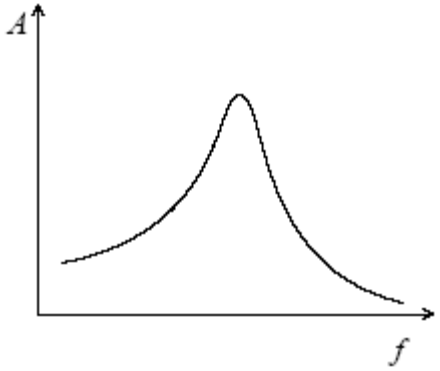
(b) pendulum bob accelerates towards centre of circular path / *OWTTE;*
therefore force upwards;
that adds to tension produced by the weight; 3

(c) (i) evidence shown of equating kinetic energy and gravitational potential energy;
$v = \sqrt{(2 \times 9.8 \times 0.025)}$;
$= 0.70 \text{ m s}^{-1}$ 2
Allow g = 10 m s^{-2} answer 0.71 m s^{-2}.

(ii) centripetal acceleration $\left(= \frac{v^2}{r}\right)\left[= \frac{0.7^2}{0.8}\right] = 0.61 \text{ (m s}^{-2}\text{)}$

net acceleration = (9.81 + 0.61 =) 10.4 (m s^{-2}) ***or*** $T - mg = m \times 0.61$;
tension= (*ma* =) 0.59 N; 3
Allow g = 10 m s^{-2} answer 0.60 N.

(d) (i)



one maximum shown and curve broadly similar to example above;
amplitude falls on each side as shown; 2

(ii) resonance is where driving frequency equals/close to natural frequency; the frequency at the maximum amplitude of the graph; 2

(e) lower amplitude everywhere on graph;
with a much broader resonance peak;
maximum moves to left on graph; 2 max
*Award **[2]** for a sketch graph.*

12. (a) (i) 1.0 mm; 1

(ii) 6.0 mm; 1

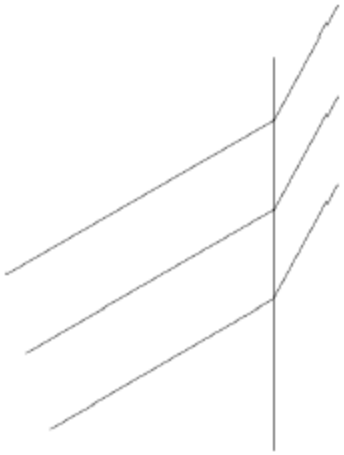
(iii) 37 Hz; 1

(iv) 0.22 m s^{-1}; 1

(b) (i) ray: direction in which energy travels;
wavefront: line connecting points with same phase/displacement; 2

(ii) $\sin r = \frac{\sin 60}{1.4}$;
$r = 38°$; 2

(iii) wavefronts continuous at boundary and parallel;
wavefronts closer together and equally spaced by eye and in the correct direction; 2

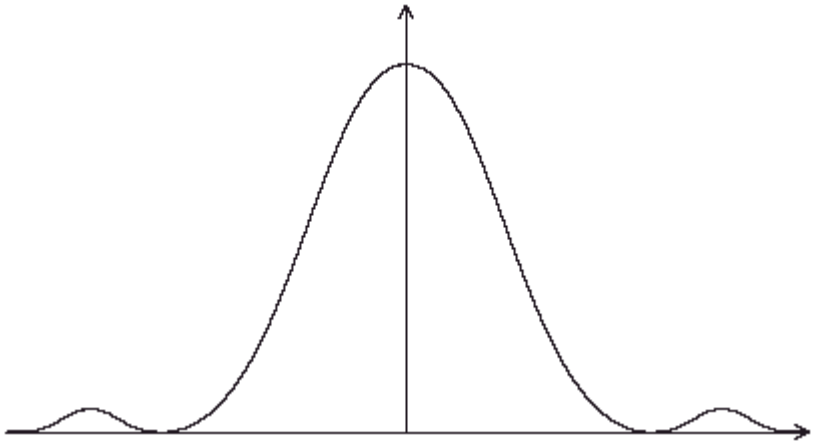


(c) (i) reference to superposition/interference;
waves (almost) cancel to give zero/small displacement;
where waves arrive out of phase/180° out/π out; 3

(ii) position of any one minimum closer to centre / minima closer together;
frequency increased so wavelength decreased / correct explanation in terms of double-slit equation; 2

13. (a) (i) spreading out of light;
beyond that predicted by the geometric pattern / by the obstacle shape / *OWTTE*; 2

(ii) *diagram*:



central symmetrical maximum;
at least one secondary maximum on each side with smaller height no more than one third height of central maximum;
minima drawn to zero; (*i.e. sitting on x-axis)* 3

(iii) $\theta = \left(\frac{\lambda}{b} =\right) \frac{620\times10^{-9}}{0.4\times10^{-3}}$;

$w = (2D\theta =) \frac{2.0\times1.9\times620\times10^{-9}}{0.4\times10^{-3}}$;

w = 5.9mm; 3

*Award **[3]** for bald correct answer.*

(b) (i) the images can be seen separately; 1

(ii) diffraction occurs (at the aperture/iris of the eye);
each lamp gives rise to a diffraction pattern (at the back of the eye/on the retina);
(for distant lamps) the two diffraction patterns overlap;
so that patterns cannot be distinguished / *OWTTE*; 4

14. (a) the phase between the two sources is changing all the time;
there is interference/superposition between the beams of light;
the interference pattern is changing too rapidly to be observed;
*Award **[2 max]** for a response stating that sources are not coherent so no interference pattern.* 3

(b) (i) stimulated emission of a group of atoms with a population inversion;
(a single stimulus triggers the) spontaneous production of many other photons simultaneously / *OWTTE*;
photons emitted have same wavelength / phase; 2 max

(ii) coherence; 1

(c) laser scans the barcode / the laser light is not reflected where the ink is dark; the reflected light is detected; 2

(d) distance between maxima is (100 × 5) = 500 m

$L = \frac{xd}{\lambda}$;

$L = \left(\frac{500\times200}{5} =\right)$ 2.0 × 10^4 m; 3

15. (a) (i) (light from the slits has) constant phase difference; 1

(ii) when two (or more) waves meet;
resultant displacement;
is sum of individual displacements; 3

or

when the path difference;
is an integral/half-integral multiple of the wavelength;
constructive/destructive interferences take place;
Allow amplitude for 3rd mark.

(b) $x = \frac{\lambda d}{a} = \frac{640 \times 10^{-9} \times 2.4}{0.85 \times 10^{-3}}$;

1.8×10^{-3} m; 2

(c) bright fringes are less bright;
dark fringes are brighter; 2

16. (a) $d = \frac{1}{8.00 \times 10^{5}} = 1.25 \times 10^{-6}$ m;

$d \sin\theta = n\lambda \Rightarrow \theta = \sin^{-1}\left[\frac{n\lambda}{d}\right]$;

$\sin^{-1}\left[\frac{2 \times 589 \times 10^{-9}}{1.25 \times 10^{-6}}\right] = 70.5°, \sin^{-1}\left[\frac{2 \times 590 \times 10^{-9}}{1.25 \times 10^{-6}}\right] = 70.7°$

$70.7° - 70.5° = 0.2°$; 4

(b) the lines are closer together / not clearly separate in the first order spectrum; 1

17. (a) light reflected from the top slide interferes with light reflected from the bottom slide; 1

(b) the light reflected from the bottom slide undergoes a π change in phase; 1

(c) in moving from one (bright) fringe to the next the thickness of the air film changes by $\frac{\lambda}{2}$;

in 5.0 cm number of fringes = $\frac{5}{0.940} \times 50 = 266$;

therefore diameter of hair = $133 \times 5.92 \times 10^{-7} = 7.87 \times 10^{-5}$ m;
= 80 μm 3