WAVES 1

1. (a) 25 000 Hz; 1

(b) frequency is too high/outside range of hearing/too high pitch; 1

(c) B; 1

[3]

2. (a) (i) to the left; 1

(ii) current produces magnetic field/coil becomes magnetic;
cause of movement in correct context;
[Reject attraction/repulsion] 2

(b) oscillates/vibrates/moves left then right/eq; 1

(c) $v = f \times \lambda$; [In any correct form]
$= 800\ (Hz) \times 0.4\ (m)$;
$= 320\ (m/s)$; [Bald correct answer scores 3 marks] 3

[7]

3. (a) (i) top diagram shows:

1. circular waves;

lower diagram shows:

2. less diffraction than top diagram;

either diagram shows:

3. at least three waves shown;

4. no change in wavelength in these waves; 4

(ii) wavelength; 1

(b) (i) $\text{wavelength} = \frac{\text{speed}}{\text{frequency}}$; [In any correct form]

$= \frac{330\,\text{m/s}}{1000\,\text{Hz}}$;

$= 0.33\ \text{m}$ 2

(ii) yes plus two from:

1. the waves spread at the opening;
2. sound/waves are diffracted;
3. as the gap is comparable to the wavelength/OWTTE; 2

(iii) An explanation to include:

1. wavelength is smaller/calculation;
2. waves would not spread/diffract as much;
3. as much smaller than gap; 3

[12]

4. (a) (i) greater/higher/more/larger/bigger;
[Reject longer] 1

(ii) longitudinal; 1

(b) (i) vibration; 1

(ii) 1.6;;
[Allow 1.3 / 3.2 / 16 for 1 mark]
[2.6 scores no mark] 2

(iii) 0.004; 1

(c) (i) reduced amplitude;
longer period shown;
(One cycle to be shown) 2

(ii) quieter/softer/less loud/volume lower/harder to hear;
lower/deeper (sound)/pitch decreases/more bass; 2

[10]

5. (a) (i) VHF / 100 (MHz); 1

(ii) long;
long range/OWTTE; 2

(iii) VHF / 100 (MHz);
(high) amount of information carried/enables stereo broadcasts; 2

(iv) long **and** medium; 1

(b) A diagram showing:
- constant frequency;
- varying amplitude (no pattern required); 2

[8]

6. (a) (i) B; 1

(ii) A; 1

(b) Hz; 1

(c) (i) An explanation to include:
1. ripples are transverse waves;
2. (movement) displacement only in the vertical plane; 2

(ii) energy; 1

[6]

7. (a) (i) changes direction;
towards the right; 2

(b) no refraction at first boundary;
reflected at second and third boundaries;
ray emerging from prism parallel to incident ray; 3

(c) at least three waves;
diffraction shown;
no change in wavelength; 3

[8]

8. (a) (i) refract(ion); 1

(ii) An explanation to include:
1. the ray bends (through an angle) / changes direction / refracts;
[Reject bends **in** water]
[Ignore reference to light direction] 2
2. the fisherman thinks it has travelled straight / virtual image;

(b) correct direction;
joined; 2
[Deduct 1 mark for each error]

[5]

9. (a) (i) higher the frequency the greater the energy / ORA; 1

(ii) An explanation to include:
1. can penetrate body / skin;
[Allow absorb / enter]
2. causing effects such as mutations, skin cancer etc /
ionise the cells / damage cells / tissue; 2

(iii) as the frequency increases the wavelength decreases; 1
(may write $v = \lambda \times f$)

(b) Any two correct statements, for example:
1. ultrasound are sound waves, radio waves are electromagnetic waves;
2. ultrasound are longitudinal, radio waves are transverse;
3. radio waves travel at the speed of light, ultrasound are much slower;
[Allow faster than]
4. radio waves can travel through a vacuum, ultrasound needs a
medium; 2
[NB **comparison** has to be made]
[Ignore references to uses, wavelength and frequency]

[6]

10. (a) 2 arrows in opposite directions;
not along the spring's direction; 2

(b) sound / p wave / compression wave / ultra sound / sonar; 1

(c) (i) 3; 1

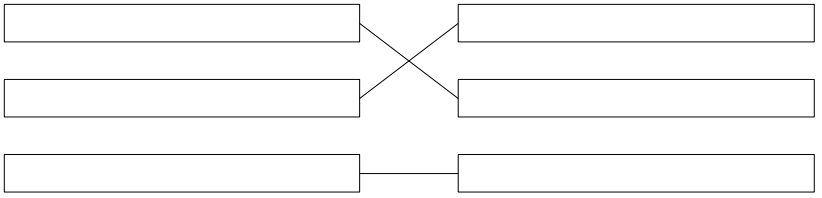
(ii) 10;; 2
[5 - 1 mark only]

(iii) A calculation to include:
1. $f = \frac{14}{7}$;
2. 2;
3. Hz; 3

[9]

11. (a) infra-red/IR; 1

(b)



3 correct;; 2
(1/2 correct – 1 mark

[3]

12. (a) (i) B (no mark) 1
biggest/largest/highest amplitude/highest/tallest wave/biggest displacement/ quantified from graph (using a comparison);

(ii) any two from
molecules of air vibrate (to and fro);
push together/at high pressure/compression/
then moves further apart/at lower pressure/raref action;
the vibrations are passed on;
(sound is a) longitudinal (wave); 2
molecules≡particles

(b) Two from:
body scan(ning);cleaning surgical instruments [**ignore** sterilising];
treating muscle strains/joints/ligaments;
treating cataracts;
breaking up kidney stones/gallstones;
dentistry; 2

[5]

13. (a) refraction towards normal in block; (must emerge at bottom surface)
emergent ray correctly refracted; (approx parallel to incident) 2

(b) (i) sunbeds/ security marking – detection of forged bank notes/ fluorescent lamps/treatment of skin complaints/ sterilisation of water/hardening fillings;
IGNORE: uv lamps 1

(ii) uv higher frequency/visible lower frequency;
uv shorter wavelength/visible longer wavelength; 2
travel at the same speed; accept labelled diagram

(c) (i) X-rays absorbed stopped/by bone;
pass through/flesh/(soft) tissue/muscle;
IGNORE arm/see through skin etc.
they affect a photographic film/darken photographic plate; 3

(ii) kills/damages cells/DNA/genes/chromosomes/cause cancer/mutations/ infertility; 1
ionisation;
IGNORE damages tissue;

[9]

14. (a) reflected; (NOT refracted) 3
(incidence;
critical;

(b) they enable light to travel round corners 1
/flexible/thin/narrow/transparent **or** energy efficient/little energy loss
or (internally)reflect light;

[4]

15. (a) $f = v / \lambda$ or in words; 1

(b) Any **two** from: 1
high (frequency) means shorter wavelength ORA explicitly shown in words or on diagram;
more diffraction for low frequency because wavelength similar to door width/ORA; 1
(diagrams must show **same** aperture size, **different** wavelengths,
and correct **diffraction** for two marks)

[3]