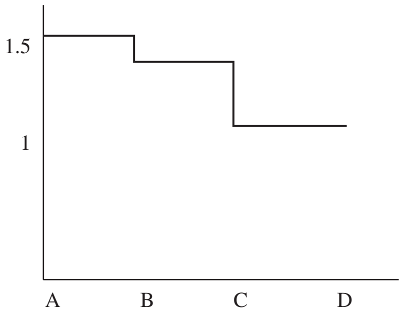
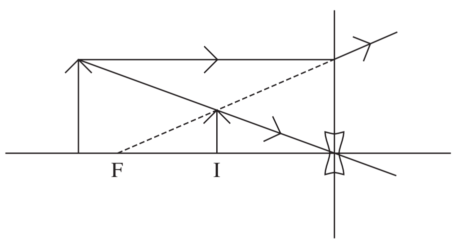
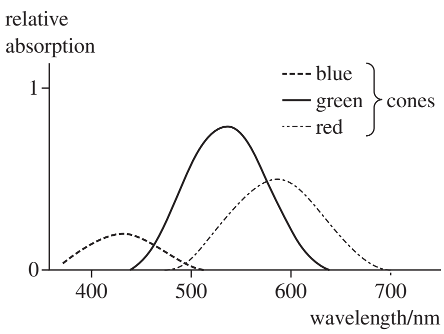
Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) **Property:** • monochromatic • collimated • coherent **Explanation:** • waves of single frequency/wavelength • produces an approximately parallel beam • waves produced are in constant phase with each other	**3**	Just stating **two** properties gains one mark, the other marks were for the explanation of the physics terms. You must know the terms, but also understand them.
(b) (i) To illuminate the inside of a body	**1**	These answers are recall of basic knowledge.
(ii) To stop bleeding/to cut tissue/to treat tumours	**1**	
(c) (i)  n (constant) = 1.5 from A to B, slight decrease and constant from B to C at C, n decreases to 1, remains at 1 from C to D	**2**	Remember, there is only a small change between core and cladding. Also, the refractive index of air is 1 not 0.
(ii) $1.5 = \frac{\sin i}{\sin 10}$ $i = 15°$	**2**	This is recall from core work.
2 (a) Two correct rays to form virtual image, with image labelled: 	**2**	This is a simple, standard ray diagram. Remember that for correction of vision, all objects are real and all images are virtual.
(b) (i) Myopia	**1**	Diverging lens used for correction of short sight, myopia.
(ii) (Use of $P = \frac{1}{u} + \frac{1}{v}$ gives) $-3.0 = \frac{1}{u} + \frac{1}{(-0.21)}$ $u = 0.57\,\text{m}\ (0.568\,\text{m})$	**3**	Remember to use a relevant sign convention: usually real distance values are positive and virtual distance values are negative

Answers to examination-style questions

Answers	Marks	Examiner's tips
3 (a) • Density of the material. • Speed of sound in the material.	**2**	You must know that acoustic impedance is the product of density and wave speed.
(b) Large difference in acoustic impedance.	**1**	
(c) **Position:** • between probe and skin. **Reason for gel:** • without it, trapped air gives large difference in acoustic impedance • gel has similar acoustic impedance to tissue • air excluded and maximum transmission.	**max 3**	This is **<u>not</u>** the same gel as would be used between the electrodes and the skin in an ECG. Many candidates get this confused and talk about electrical conducting gel.
4 (a) • Electrical potential axis: mV 0 where line cuts axis to 1 at top of peak • Time axis: s 0 at start to 0.8 at end of trace (tolerance 0.2)	**2**	The 0 on the potential axis is not where the axes meet. Many candidates also forget to put units on the axes.
(b) Depolarisation: potential across membrane going from – to + (*or* changes sign). Repolarisation: potential across membrane going from + to – (*or* back to resting potential). Depolarisation is due to movement of Na^+ ions into the cell. Repolarisation due to movement of K^+ ions out of cell.	**3**	The sign of both the sodium and potassium ions is important and should be included in the answer.
(c) P – atrial depolarisation/signal from sinoatrial node causes atria to contract. Q – (ventricular depolarisation) causes ventricles to contract and (atrial repolarisation allows) atria to relax. T – ventricular repolarisation allows ventricles to relax.	**3**	This links the process and the action. The relaxation of the atria is often forgotten as it is masked by the depolarisation of the ventricles.

Answers to examination-style questions

Answers	Marks	Examiner's tips
5 (a) • Anode angled to make small source area. • Acts like a point source to produce no penumbra. • Rotates to allow smaller target area.	**max 2**	It is important to realise how the X-rays are made to appear to come from a small source area, and the reason for this.
(b) 1 mark for each method and explanation. Examples: • 'Window' defining target area – less exposure to surrounding tissue. • Use of lead apron to cover area not to be photographed – less exposure to body as a whole. • Use of (aluminium) filter – reduces % of less energetic X-rays which would only be absorbed by the body. • Selected energy of X-rays – best energy for picture production. • Use of intensifying screen//contrast medium – shorter exposure time.	**max 3**	Both the method and a sensible explanation are needed to gain a mark.
(c) $\mu = \ln \frac{2}{1.5} = 0.46$ $\frac{I}{I_0} = e^{-\mu x}$ $= 0.57$	**3**	Hint – this relationship between the attenuation coefficient and the half thickness is similar to half life and decay constant in radioactivity.
6 (a)  Marks for: • blue green red curves – in the correct order • relative heights of the curves and peak wavelengths • ranges of wavelengths.	**3**	This is an important diagram. Many students do not draw the curves in proportion and lose both of the final marks.
(b) (i) $\frac{8 \times 10^{-3}}{40} = \frac{y}{19 \times 10^{-3}}$ $y = 3.8 \times 10^{-6}\,\text{m}$	**2**	The maths is simpler if you consider similar triangles.
(ii) $y > 2 \times$ diameter of a cone will resolve as there must be one unstimulated cone between the two stimulated cones.	**2**	This is an important fact and you should understand why it must be larger than 2 diameters for resolution to be certain.

Answers to examination-style questions

Answers	Marks	Examiner's tips
7 (a) • Minimum intensity that a normal ear can hear . . . • at a frequency of 1 kHz.	**2**	Many candidates fail to mention that this is at the standard frequency.
(b) (i) • Listen to sound at 1 kHz 40 dB. • Listen to sound at a different frequency. • Change the intensity until it is perceived as the 'same loudness' as the 1 kHz sound. • Repeat for frequencies from 30 Hz to 10 kHz.	**max 3**	You are comparing the perception of sounds at different frequencies with a sound at the standard frequency. Candidates were expected to get values from the graph shown: 40 dB at 1000 Hz and frequencies from 30 to 10 kHz. Remember to use the information given.
(ii) At 100 Hz the intensity is 60 dB Use $I = I_0 \times \text{antilog}\left(\frac{60}{10}\right)$ $I = 1.0 \times 10^{-6}\,\text{W m}^{-2}$ Power $= I \times$ area $= 1.2 \times 10^{-11}$ W	**3**	This is from the graph. Make sure you can rearrange basic equation. This expects you to use the definition of intensity.
8 (a) • The backing material damps the oscillation of the crystal to zero quickly . . . • when driving signal is removed.	**2**	
(b) A-scan probe has single transducer, but B-scan probe uses multi-transducer probe.	**1**	This is a perfect example where you must read the question. Many candidates' answers said what the difference was between A and B scans, but failed to talk about the difference between the probes used.
(c) (i) Time for double distance = 0.27 – 0.12 = 0.15 (m s) Diameter $= \frac{1200 \times 0.15 \times 10^{-3}}{2}$ = 0.090 m	**2**	Be careful to obtain accurate values from the figure shown. Remember that this is an echo and thus travels there and back in the time recorded.
(ii) • Only partial reflection at boundary • Attenuation as signal passes through body	**2**	The first point might be obvious, but you must still realise that it is part of the answer.
9 (a) (i) $N = \frac{I}{e} = \frac{48 \times 10^{-3}}{1.6 \times 10^{-19}} = 3.0 \times 10^{17}$ **(ii)** $E = QV = 90 \times 10^{3} \times 1.6 \times 10^{-19}$ $= 1.4 \times 10^{-14}$ J	**2**	Remember that basic work from core units can be examined as part of the option. These are both fundamental equations.

Nelson Thornes is responsible for the solution(s) given and they may not constitute the only possible solution(s).