Paper 2 Practice questions (AS Level) Answers

Question	Answer	Marks
Section A		
1 a	(A gas) in which some atoms/molecules/particles have lost electrons to become positive ions/charged ions.	1 1
1 b	$\lambda = \frac{c}{f} = 1.0(3) \times 10^{-7}$ m	1
1 c	$E = VQ = 240 \times 1.6 \times 10^{-19}$ $=3.8(4) \times 10^{-17}$ J	1 1
1 d i 1	240 V	1
1 d i 2	120 V	1
1 d ii	From the graph, 0.26(4) μA Power = $2.64 \times 10^{-7} \times 180 \times 6.2 \times 10^{6}$ = 295 W	1 1 1
2 a i	There are many small crystals with close-packed planes of different alignments/with grain boundaries.	1 1
2 a ii	Ductile means it can be drawn into a wire. Two marks for any two further points, e.g.: • In the pure metal, there is a dislocation in the regular crystal where atoms are free to move. • Slips occur easily where planes move over each other.	1 2
2 b i 1	Hard materials are difficult to dent or scratch (they resist wear).	1
2 b i 2	Hard materials last longer / don't blunt so easily / give a cleaner or more accurate cut.	1
2 b ii	Any two points from e.g.: • Metals have free/delocalised electrons. • Metals have non-directional bonds • which hold positive ions in lattice / allow positive ions to slip or dislocate. Any two points from e.g.: • In diamond, there are bound/localised electrons • which form strong directional bonds. • Diamond forms a giant lattice that is hard to displace.	2 2
3 a i 1	2.0 km h^{-1}	1
3 a i 2	8.0 km h^{-1}	1
3 a ii	Time = $\frac{\text{distance}}{\text{velocity}}$ Time from **A** to **B** = $\frac{2\,\text{km}}{(5-3)\,\text{km h}^{-1}} = 1$ h Time from **B** to **A** = $\frac{2\,\text{km}}{(5+3)\,\text{km h}^{-1}} = 0.25$ h Total time = 1 + 0.25 = 1.25 h (1.3 h to 2 s.f.)	1 (for method) 1
3 b i	Either correct scale drawing OR $\sin^{-1}\left(\frac{3.0}{5.0}\right)$ = 36.8… = 37° (2 s.f.)	2 1 1
3 b ii	resultant velocity = $\sqrt{3.0^3 + 5.0^2}$ = 4.0 km h^{-1} (alternatively using sin or cos 37° and a known velocity)	1 1

3 c	Time taken for **Q** to reach **C** = $\frac{\text{distance}}{\text{velocity}} = \frac{2.0}{4.0} = 0.50$ h Therefore distance travelled by **P** = 0.5 × 2.0 = 1.0 km $\theta = \tan^{-1}\frac{1.0}{2.0} = 26.5\ldots = 27°$ (2 s.f.)	 1 1
4 a i	Straight line passing through the origin of half the gradient of A.	1
4 a ii	Straight line passing through of 4 times the gradient of A.	1
4 b i	(Direct) proportionality/straight line through origin.	1
4 b ii	$\sigma = \frac{1.2(8)\times10^{8}}{1.3\times10^{8}}$ $\varepsilon = 0.00070$ $E = 1.8(3) \times 10^{-11}$ Pa	1 1 1
4 c	Any 4 sensible points, e.g.: • Metal atoms lose electrons/form positive ions. • Free/delocalised (negative) electrons are present. • Attractive forces/non-directional bonding between positive and negative ions cause bonds. • Positive metal ions are closely-packed/regularly stacked in planes or lattices. • When positive ions are given small displacement, atomic planes move relative to neighbours. • Ions return to their positions when the displacing force is removed.	4
Section B		
1 a i	power = $\frac{1}{4.5\times10^{-3}} = 222$ D	1
1 a ii	$\frac{1}{v} = -2 + 222 = 220$ D $v = 4.5(4) \times 10^{-3}$ m	1 1
1 a iii	$\frac{v}{u} = \frac{4.54\times10^{-8}}{0.5}$ $= 9.1\times10^{-3}$	1 1
1 b	Multiply both dimensions by 9.1×10^{-3} gives dimensions 2.4 × 2.0 mm	
1 c	Resolution = $\frac{270}{1200}$ = 0.23 mm This is bigger than the width of an eyelash so if eyelashes are not separated by at least a gap of about one eyelash thick, they will not be resolved.	1 1 1
1 d i	256 levels are coded by 8 bits, which gives 3 × 8 = 24 bits per pixel bits in one image = $24 \times 1200 \times 1000 = 2.88 \times 10^{7}$ number of images = $\frac{0.9\times10^{9}}{2.88\times10^{7}} = 31$ images	1 1 1
1 d ii	decrease bits per image by e.g. fewer intensity levels but this will decrease image quality/accuracy of the match with object.	1 1 1

2 a	Marks are awarded for a well-structured answer. Relevant points can include e.g.: • At low temperatures, NTC thermistors have a very large resistance whilst PTC thermistors have a reasonably low resistance. • At high temperatures, NTC thermistors have low (next to no) resistance whilst PTC thermistors have a very large resistance. • NTC thermistors display a steady exponential decline in resistance with increasing temperature. • PTC thermistors have a relatively steady resistance, with large and sudden increase at a given temperature. • Reasons: e.g. The molecules/atoms in an NTC thermistor require energy to allow electrons to pass through the material. • Reasons: e.g. The molecules/atoms in a PTC resistor change structure at a given temperature/energy so that no electrons can pass freely through to material.	6
2 b	The PTC thermistor shows a large range of resistance over a small temperature range (over 100 °C), but little change around 50 °C, so it would not be suitable for keeping something at 50 °C. The NTC thermistor shows a steady decreases in resistance over this temperature range, so it would be suited to the task	1 1
2 c i	$P = IV = \frac{V^2}{R}$ $= \frac{6.0^2}{100}$ $= 0.36\ \text{W}$	1 1 1
2 c ii	When the current is switched on, the temperature rises. This rise causes a slight decrease in resistance. At around 50 °C the resistance remains steady. So the current will remain steady.	1 1 1 1
Section C		
1 a i	Measuring from the glass casing of the lamp rather than filament/refraction due to the glass casing	1
1 a ii	Difficulty when the image of the lamp is most clear.	1
1 b i	When the image is larger and dimmer the point of greatest sharpness/clarity is harder to judge.	1 1
1 b ii	If the absolute uncertainty increases in proportion to distance the ratio absolute uncertainty/distance will remain constant.	1 1
1 c	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{0.260} - \left(-\frac{1}{1.000}\right) = \frac{63}{13}\ \text{m}^{-1}$ $f = \frac{13}{63} = 0.206\ \text{m}$	1 1
1 d	Calculating lowest value of f as 0.200 highest value as 0.212 range = +/- 0.006 m which is greater than 5 mm	1 1 1 1
1 e	Equation is of the form $y = mx + c$ y identified with $\frac{1}{v}$, x identified with $\frac{1}{u}$, and c (y-intercept) with $\frac{1}{f}$.	1 1
1 f	$\frac{1}{f} = 5.0\ \text{m}^{-1}$ so $f = 0.20\ \text{D}$	1
1 g	Best-fit line highlights the presence of outliers. A simple mean could be incorrectly weighted by such data points.	1