Assess Quizzes from the o-book – Explanations for the answers.

Chapter 0 Review – Support

Q	Reason
1	SI unit for force is 'newton'. See NCPQ U1&2 page 7.
2	The non-SI units listed are: hour, gram, joule. The following are physical quantities, not units: mass, temperature, time. See page 7.
3	There are 10^3 *mm* in a *m*, and a 10^3 *m* in a *km*, so there are $10^3 \times 10^3 = 10^6$ *mm* in a *km*. Page 7
4	All 5 digits are significant. The right-most zero is significant as it is not there just to show the decimal place. See page 11.
5	The relationship is inverse. You just have to learn the shapes. See page 26 onwards.
6	It is random as sometimes you might read a bit higher than the best estimate, and other times measure a bit under it. With the others, you always read either over or under. See page 18.
7	$E_a = \lvert x_O - x_A \rvert$, which says the absolute error equals the absolute value of the observed reading (x_O) and the accepted value (x_A). The lines mean that you ignore any +/- sign in your answer. See page 24.
8	The 50 mA scale is the top scale and the needle is somewhere between 6 and 7. You have to judge where it is to the nearest half-scale division. Each division is worth 1 mA so a half-scale division is 0.5 mA. Thus, you need to read the position as 6.0, 6.5 or 7.0. To me, it looks closest to 6.5 mA, so the best estimate of the reading is 6.5 ± 0.5 mA. See page 19.
9	The reading 6.5 ± 0.5 mA. This can be stated as 'best estimate' ± 'uncertainty'. The formula to work out percentage uncertainty is: $$\begin{aligned}\delta\% &= \frac{\delta}{x_O}\times 100\% \\ &= \frac{0.5}{6.5}\times 100\% \\ &= 7.7\%\end{aligned}$$
10	$$\begin{array}{r} 101.3 \\ +\ \ 25.56 \\ \hline =126.89 \end{array}$$ The first column on the right (least significant decimal place) is the 'tenths' column (1st decimal place) so that is the last one you can report with confidence. But you need to round off the answer to one decimal place and that would be *126.9 g* and that is the answer.

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Chapter 0 Review – Consolidate

Q	Reason
1	$E_a = \|x_O - x_A\| = \|3980 - 4180\| = 200 Jkg^{-1}K^{-1}$ $E\% = \frac{E_a}{x_A} = \frac{200}{4180} \times 100 = 4.8\%$
2	$E\% = \frac{E_a}{x_A} \times 100$ $E_a = \frac{E\% \times x_A}{100} = \frac{2 \times 78}{100} = 1.6$ $E_a = \|x_O - x_A\|$ $x_O = x_A \pm E_a$ $= x_A + E_a = 78 + 1.6 = 79.6\,^{\circ}C$ $= x_A + E_a = 78 - 1.6 = 76.4\,^{\circ}C$
3	Area =21.30 (4 sf) ×1.53 (3 sf) = 32.589 mm^2. Need to round it off to the least number of *sf* in the multiplicands (3 sf). Answer is 32.6 mm^2. See page 11.
4	Lowest systematic error will be the one that goes through the origin (assuming the relationship is linear, as Ohm's law would be). Graphs A and B show this. The one with lowest random error is the one whose points are not widely scattered. Graphs B and D are lie this. Hence, to have low systematic error and random error it must be Graph B. See page 34, 35.
5	Most *precise* is one with lowest random error (B, D). One with significant zero error is one that doesn't go through the origin but is offset to a higher or lower y-intercept. In this case Graph D has a positive zero error that is significant. Answer is thus D. See page 34, 35.

Chapter 0 Review – Extend

Q	Reason
1	y = mx + c represents a linear relationship but not directly proportional so it may have a y-intercept that is not at the origin (0, 0). This could be either Graph C or D. Secondly, a low R^2 value indicates a high spread of results about the trendline. R^2 is a measure of how well the trendline accounts for the data points. Low R^2 means the data points are not well accounted for by the line and have a high spread. This could be Graph A or C. Answer then is C as it is common to both. See page 35.
2	To linearise a $y \propto x^2$ you need to plot the y values on a uniform scale on the vertical axis as before, and plot x^2 on a uniform scale along the horizontal axis. Thus, plot y vs x^2, or in this case, Q vs I^2. See page 32.

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3	This sounds like a zero-error uncertainty which is 'systematic' as it will always provide readings that are on the same side of the best estimate ('correct') value. You need to adjust it so that it reads zero when it is not measuring anything. This is not easy with many scales. For example, you can't adjust the liquid level in a thermometer, but you can make a note on it that it always reads a stated amount over or under. See Table 1 page 17.
4	$t = \frac{s}{v} = \frac{1\times10^{-15}}{3\times10^{8}} = \frac{10^{-15}}{3\times10^{8}}$
5	$\text{no. molecules} = \text{glasses in the ocean} \times \text{no. molecules per glass}$ $= \frac{\text{mass of ocean}}{\text{mass of 1 glass}} \times 8\times10^{23}$ $= \frac{1.4\times10^{21}}{0.25} \times 8\times10^{23}$