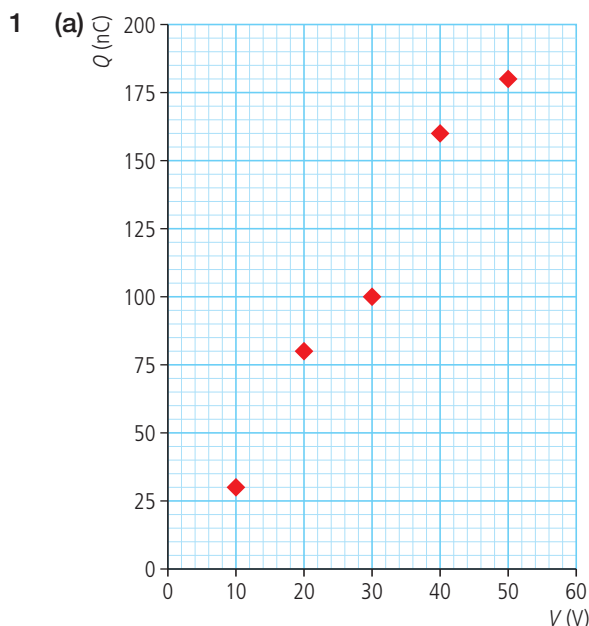


Skills practice questions answers



half area of graph paper at least to be used;
axis labels, including units;
scale;
data points; ((0, 0) need not be included) [4]

- (b) absolute uncertainty in Q at 10.0V = ± 3 nC;
absolute uncertainty in Q at 50.0V = ± 18 nC;
Or read from graph or elsewhere in the question and do not deduct unit mark.
correct placing on graph; [3]

- (c) from top of error bar at (50, 180) to bottom of error bar at (10, 30);
use of at least half the line or algebraic indication;
value = 4.3 or 4.3×10^{-9} ; [3]
Watch for ECF.

- (d) CV^{-1} ; [1]
Unit might be given in (c).

- (e) recognize that the gradient $m = \frac{\epsilon_0 A}{d}$;
therefore $\epsilon_0 = \frac{dm}{A}$;
$$= \frac{0.51 \times 10^{-3} \times 4.3 \times 10^{-9}}{0.15}$$

$$= 1.5 \times 10^{-11} \text{ CV}^{-1} \text{ m}^{-1}$$

($\text{C}^2 \text{ N}^{-1} \text{ m}^{-2}$ – data book unit or Fm^{-1}); [4]

[Total 15 marks]

- 2 C [1]
3 A [1]
4 C [1]

- 5 C [1]
6 C [1]
7 D [1]
8 B [1]
9 C [1]

- 10 (a) line of best fit is not straight / line of best fit does not go through origin; [1]
(b) smooth curve;
that does not go outside the error bars; [2]
Ignore extrapolations below $n = 1$.
(c) we can rewrite the suggested relation as $\log D = \log c + p \log n$;
now we can plot a graph of $\log D$ versus $\log n$;
the slope of the (straight line) graph is equal to p ; [3]

Accept logs in any base.

- (d) (i) absolute uncertainty in diameter D is ± 0.08 cm;
giving a relative uncertainty in D^2 of
 $2 \times \frac{0.08}{1.26} = 0.13$ or 13%; [2]
Award [2] if uncertainty is calculated for a different ring number.
(ii) it is possible to draw a straight line that passes through the origin (and lies within the error bars);

or
the ratio of $\frac{D^2}{n}$ is constant for all data points; [1]

- (iii) gradient = k ;
calculation of gradient to give 0.23
(accept answers in range 0.21 to 0.25);
evidence for drawing or working with lines of maximum and minimum slope;
answers in the form $k = 0.23 \pm 0.03$; [4]
Accept an uncertainty in k in range 0.02 to 0.04.
First marking point does not need to be explicit.

- (iv) cm^2 ; [1]

[Total 14 marks]