1. B

[1]

2. C

[1]

3. B

[1]

4. B

[1]

5. A

[1]

6. C

[1]

7. A

[1]

8. C

[1]

9. C

[1]

10. D

[1]

11. B

[1]

12. B

[1]

13. C
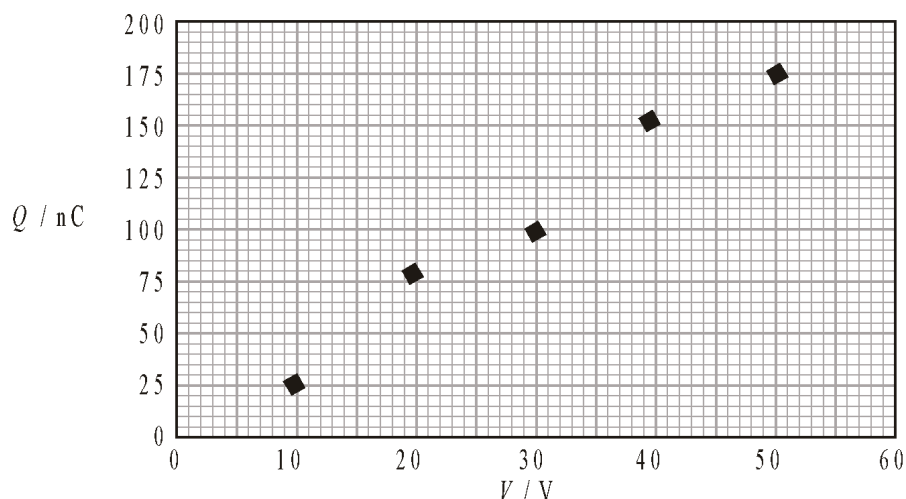
[1]

14. B

[1]

15. B

[1]

16. C

[1]

17. (a)

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

(b) absolute uncertainty in Q at 10.0 V = ±3 nC;
absolute uncertainty in Q at 50.0 V = ±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 $m = \dfrac{\varepsilon_0 A}{d}$;

therefore $\varepsilon_0 = \dfrac{dm}{A}$;

$= \dfrac{0.51 \times 10^{-3} \times 4.3 \times 10^{-9}}{0.15}$;

$= 1.5 \times 10^{-11}$ C V^{-1} m^{-1} (C^2 N^{-1} m^{-2} – data book unit or F m^{-1}) ;   4

[15]

18. (a) a straight line / linear graph cannot be drawn that <u>lies within all the error bars</u>;   1

   (b) smooth curve;
   that does not go outside error bars;   2

   (c) recognize that $D\lambda$ is the gradient of the graph;
   suitable triangle $\Delta\lambda \geq 100$ nm;
   to give magnitude $1.15 – 1.40 \times 10^{-5}$ nm^{-1} / 10^4 m^{-1};
   negative sign;   4

   (d) (i) recognize that A is the intercept on the n axis;
   line shown extrapolated;
   A = 1.6020($\pm$ 0.0001);   3
   Award full marks for correct answer with omission of first
   marking point award [2 max] if they find the gradient (B)
   and then use a data point to calculate A.

   (ii) it is the value of n / refractive index for an infinite wavelength /
   λ = infinity / minimum value of n;   1

   [11]