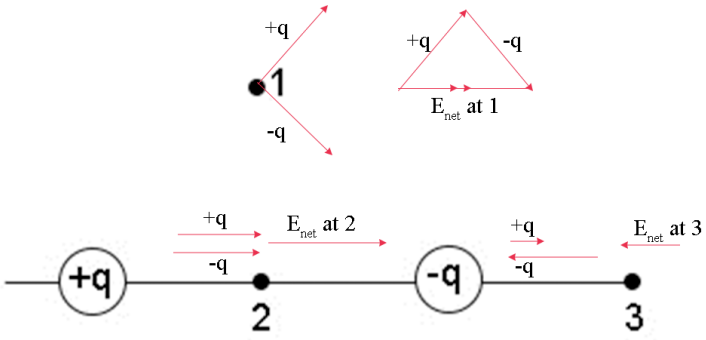
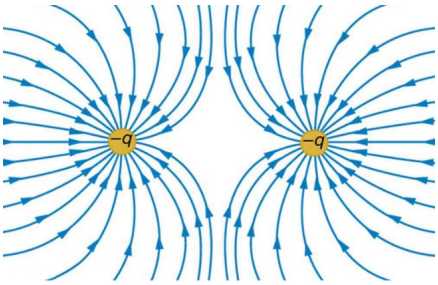
Assess Quizzes from the o-book – Explanations for the answers.

Chapter 6 Review – Support

Q	Reason
1	$F_1 = \frac{kqq}{r^2}$ $F_2 = \frac{k \times 2q \times 2q}{\left(\frac{r}{2}\right)^2} = \frac{16kqq}{r^2} = 16F_1$
2	 See the net field at points 1, 2, and 3 in the above diagram. They are not all to scale.
3	Field lines radiate away from positive and into negative. Thus, the correct diagram has field lines radiating in towards both circles. See Figure 2 on page 163 of your NCPQ text for examples. Here's a clear example if you can't find your textbook: 
4	$F_1 = \frac{kQq}{r^2} = 20.0\,N$ $F_2 = \frac{k \times 2Q \times 2q}{r^2}$ [each charge doubled in size] $= 4\frac{kQq}{r^2}$ $= 4F_1 = 80.0\,N$

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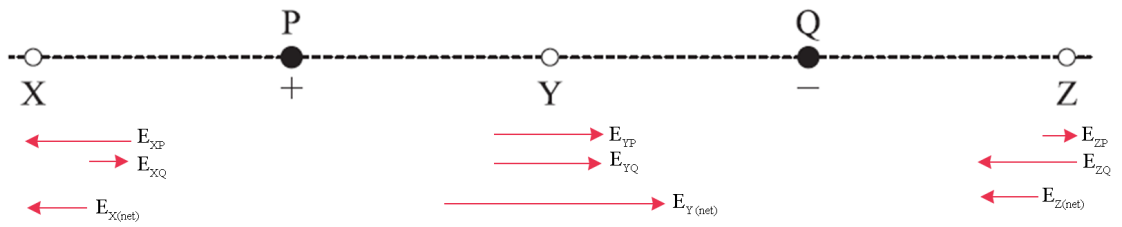
5	 Not to scale but the last line shows the direction of the field at X, Y and Z.
6	A positive charge will move in the direction of the field (by definition of the direction of a field). Hence, the charge moves up the page (well, actually curves upwards). The question asks about the force and its direction is up the page as the charge moves up the page.
7	A negative charge will move in a direction opposite to the field direction. The electron will curve downwards. Answer: down the page.
8	$F = \frac{kQq}{r^2}$ Each Q (either Q or q) represents the magnitude of charge on an object in coulomb. They are multiplied together as Q × q so Qq is the product of Q and q each in coulomb.
9	$\frac{1}{4\pi\varepsilon_o} = 9\times10^9$ $\varepsilon_o = \frac{1}{4\pi\times9\times10^9}$
10	1×10^{-6} smallest $10\mu C = 10\times10^{-6} = 1\times10^{-5}$ middle $0.0001C = 1\times10^{-4}$ largest

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Chapter 6 Review – Consolidate

Q	Reason
1	$F = \frac{kQ_1Q_2}{r^2}$ $F_2 = \frac{k2Q_1 \times 3Q_2}{r^2}$ $= 6\frac{kQ_1Q_2}{r^2}$ $= 6F$
2	$F = \frac{kQq}{r^2} = \frac{kQ_1q}{r^2} = \frac{9\times10^9 \times 40\times10^{-6} \times 40\times10^{-6}}{2.0^2} = 3.6\,N$ [repulsion]
3	$F_{qQ_1} = \frac{kQ_1q}{r^2} = \frac{9\times10^9 \times 30\times10^{-6} \times 40\times10^{-6}}{2.0^2} = 2.7\,N$ *repulsion* $F_{qQ_2} = \frac{kQ_2q}{r^2} = \frac{9\times10^9 \times 30\times10^{-6} \times 40\times10^{-6}}{3.0^2} = 1.2\,N$ *attraction* $F_q = \overleftarrow{2.7N} + \overrightarrow{1.2N}$ $= \overleftarrow{1.5N}$
4	A and C are both the same distance away from Q so will experience the same electric field strength. B will experience the strongest field strength of all points as it is the closest to Q. E is further away from Q than A or C is from Q, so E will experience a smaller field strength than A or C. If you were keen you could work out a numerical value for the field strength at each point. For example, the side of each square be 1 unit of length: [next page]

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	$E_B = \frac{kQ}{r^2} = \frac{kQ}{(1)^2} = 1.00\,kQ$ $E_{A,C} = \frac{kQ}{r^2} = \frac{kQ}{(\sqrt{1^2+1^2})^2} = \frac{kQ}{2} = 0.50kQ$ $E_E = \frac{kQ}{r^2} = \frac{kQ}{(2)^2} = 0.25\,kQ$ $E_{D,F} = \frac{kQ}{r^2} = \frac{kQ}{(\sqrt{1^2+2^2})^2} = \frac{kQ}{5} = 0.20\,kQ$ $E_H = \frac{kQ}{r^2} = \frac{kQ}{(3)^2} = 0.11kQ$ $E_{G,I} = \frac{kQ}{r^2} = \frac{kQ}{(\sqrt{1^2+3^2})^2} = \frac{kQ}{10} = 0.10kQ$
5	Negative charge will experience a force in direction opposite to the arrows. The only point that is closer than P is point A, and as the field lines are closer together at A (meaning higher electric potential), the force will be stronger.

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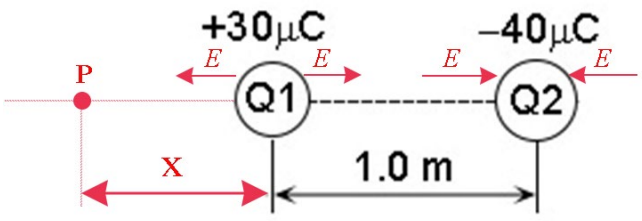
Chapter 6 Review – Extend

Q	Reason
1	$E = \frac{F}{q}$ $E = \frac{W}{q \times d} (as\, W = Fs)\, or\, W = Fd$ (if we use d instead of r) $E = \frac{W}{q} \times \frac{1}{d}\ (rearrange)$ $E = V \times \frac{1}{d}\ (as\, V = \frac{W}{q})$ see NCPQ U1&2 page 217 $E \propto \frac{1}{d} (inverse)$ Relationship is inverse. As ***d*** is increased, ***E*** decreases (V is constant).
2	The electric field between oppositely charged plates is uniform, thus the field strength is constant. All points in the field have the same E value.
3	$F_{Q_1Q_2} = \frac{kQ_1Q_2}{r^2} = \frac{9\times10^9 \times 40\times10^{-6} \times 40\times10^{-6}}{1.0^2} = 14.4N = F$ $F_{Q_1q} = \frac{kQ_2q}{r^2} = \frac{9\times10^9 \times 40\times10^{-6} \times 30\times10^{-6}}{2.0^2} = 2.7\,N$ $Try\, \frac{3F}{16} = \frac{3\times14.4}{16} = 2.7N.\ Correct.$
4	 Point P has to be on outside of Q1 so the fields from Q1 and Q2 are in opposite directions and can cancel. Point P can't be in the middle as fields from Q1 and Q2 are in the same direction. Point P also has to be on the lefthand side of Q1 because Q1 is weaker than Q2 but Q1 is closer to P than Q2. We can let the distance from P to Q1 be x. Thus, the distance of P from Q1 is x, and the distance from P to Q2 is 1 + x.

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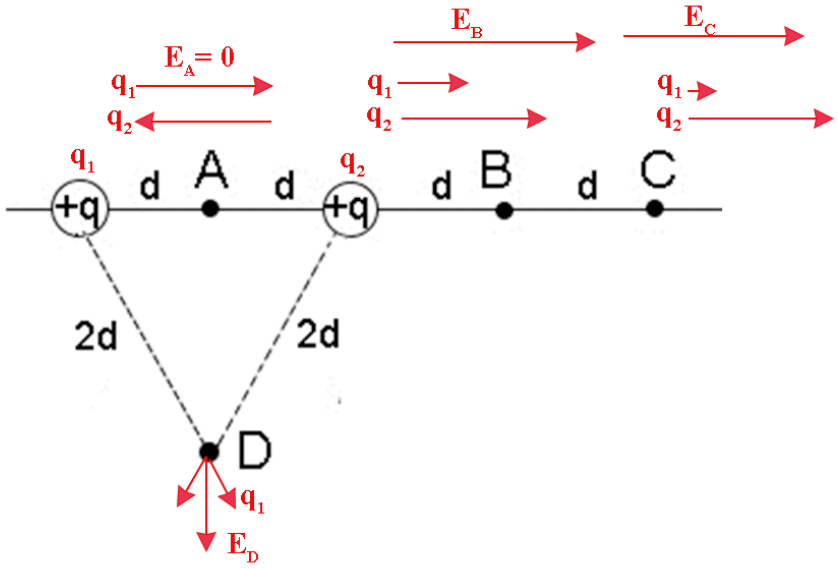
	$E_{PQ1} = E_{PQ2}$ $\frac{kQ_1}{(r_{PQ1})^2} = \frac{kQ_2}{(r_{PQ2})^2}$ $\frac{30}{(x)^2} = \frac{40}{(x+1)^2}$ (cancel out k, and μ) $\frac{3}{4} = \frac{(x)^2}{(x+1)^2}$ (rearrange) $\sqrt{\frac{3}{4}} = \frac{x}{x+1}$ $0.866(1+x) = x$ $0.866 + 0.866x = x$ $0.866 = 0.134x$ $x = 6.5\,m$
5	 The field at B is the biggest, then C, then D, then A. It can be shown mathematically that the fields at the four points are:

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$E_A = 0$

$E_B = 1.1\dfrac{kq}{d^2}$

$E_C = 0.75\dfrac{kq}{d^2}$

$E_D = 0.43\dfrac{kq}{d^2}$ [see below]