Chapter 6 Electrostatics. Revision Questions page 177-179 – Multiple Choice Answers

Q	Ans	Explanation
1	C	$F = \frac{kQq}{r^2}$ $F_2 = \frac{kQq}{(2r)^2} = \frac{kQq}{4r^2}$ $= \frac{F}{4}$
2	B	This is the same explanation for when you push on an object. It pushes back with the same force. The same idea applies when you hold an object at rest on the palm of your hand. The forces are equal so there is no acceleration. If one force was bigger than the other, then there would be a net force and the object or your hand would accelerate. That means you could never hold something at rest in your hand – which is clearly absurd.
3	A	$V = \frac{W}{q}$ $W = Vq$ $W_{X\to Y} = (^+10 - {}^+2) \times 10 \times 10^{-6} = 8 \times 10^{-4}\,J$ $W_{Y\to Z} = (^+10 - {}^+10) \times 10 \times 10^{-6} = 0\,J$
4	A	Assume electrons are 1.0 m apart: $F_e = \frac{kQq}{r^2} = \frac{9\times10^9 \times (1.6\times10^{-19})^2}{1.0^2} = 2.3\times10^{-28}\,N$ $F_g = \frac{GMm}{r^2} = \frac{6.67\times10^{-11}\times(9.1\times10^{-31})^2}{1.0^2} = 5.5\times10^{-71}\,N$ $2.3\times10^{-28}\,N > 5.5\times10^{-71}\,N$ $\therefore F_e > F_g$

5	B	It is an inverse squared relationship so that when distance *r* is doubled to *2r*, the force F_2 is one-quarter of F. One-quarter of 16 N is 4 N. $F = \frac{kQq}{r^2}$ $F_2 = \frac{kQq}{(2r)^2} = \frac{1}{4}\times\frac{kQq}{r^2} = \frac{1}{4}\times F = \frac{1}{4}\times 16 = 4N$
6	C	The forces on the electron due to the charges at top-right and bottom-left cancel out as the charges are equal in magnitude (1q) and sign (+). They both attract the negative charge in the middle equally (and oppositely) so the net force due to that pair is zero. However, the charge at the top-left attracts the charge at C, and the charge at bottom-right repels the charge at C (both are negative so are like charges and repel). The net force on the charge at C is thus towards the top-left.
7	D	3 metres is 3 times the distance, therefore 1/9 the strength. Hence 18/9 = 2 N. Mathematically, $E_{R/+q} = \frac{kQ}{r^2} = \frac{kQ}{1^2} = kQ = 18\,NC^{-1}$ $E_{S/+q} = \frac{kQ}{r^2} = \frac{kQ}{3^2} = \frac{kQ}{9} = \frac{18}{9} = 2\,NC^{-1}$
8	B	Field direction is away from a positive charge. The definition say that the direction of an electric field is the direct of the force on a positive test charge at that location.
9	C	The charge is moving downwards. The question should have said A negatively charged particle is fired into an electric field **to** the left and undergoes motion as shown in Figure 6. The electron is moving upwards but there is a downwards force on it causing it to veer downwards. A downward force on a negative charge means the direction of the field is upwards.
10	D	The electric potential (V) is negative (or sometimes stated a zero) at the negative plate and it increases in the positive direction the closer it is to the positive plate. Point C is the closest to the positive plate, so C has the highest potential. As a sidenote, the electric field strength is the same at all three points, and that's how I was trying to trick you.