Chapter 24 Answers

(#1) $\Delta K = qV$ $\quad \frac{1}{2}mv^2 = qV$

$$v = \sqrt{\frac{2qV}{m}} = \sqrt{\frac{2(1.6\times10^{-19}C)(12{,}000V)}{9.11\times10^{-31}kg}}$$

$$= 6.5\times10^{7}\ V$$

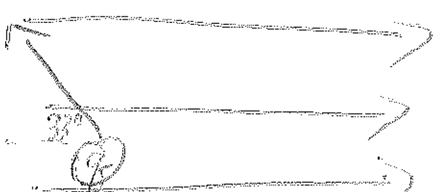
B

(#2) Potential Difference is the difference in energy per unit charge between 2 pts in an electric field. Since $W = \Delta E \Longrightarrow$

C

(#3)

$E = 3.5\times10^5\ N/C$



~~$V = \frac{E}{q} = \frac{3.5\times10^5 N/C}{5\mu C} = 7\times10^{10}\ V$~~

$\Delta x = (.5m)(\cos 33°) = .419m$

$F = qE = (5\mu C)(3.5\times10^5 N/C) = 1.75N$

$W = F\Delta x = (1.75N)(.419m) = $ **.733 J**

or can do
$V = \frac{E}{x}$
$W = q\cdot V$

D

(#4) $W = q \cdot V = (5C)(12V) = 60J$

[E]

(#5)

$F_{e\uparrow} = F_{g\downarrow}$

$qE = mg$

$q\frac{V}{\Delta x} = mg$

$V = \frac{mg\Delta x}{q} = \frac{(7.4 \times 10^{-17} kg)(9.81 m/s^2)(.006 m)}{5 \cdot (1.6 \times 10^{-19} C)(.006 m)}$

[A]

$= 5.44V$

(#6) $V = \int E dx = E\Delta x = (15000 N/C)(.02m) = 300V$

[D]

(#7) $W = qV = (1.6 \times 10^{-19} C)(50V) = 8 \times 10^{-18} J$

Since the potential is decreasing, the field is doing work on the charge so the energy is expended.

[B]

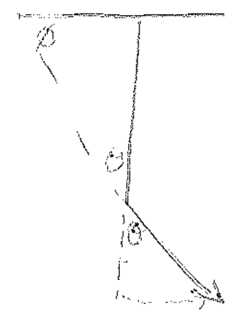
(#8) $V = \sum \frac{kQ}{r} = \frac{(9\times10^{9}\,Nm^2/C^2)(3.2\times10^{-19}C)}{1nm} + \frac{(9\times10^{9}\,Nm^2/C^2)(3.2\times10^{-19}C)}{1nm}$

$- \frac{(9\times10^{9}\,Nm^2/C^2)(3.2\times10^{-19}C)}{.8nm} = 2.16\,V$

[A]

(#9) E is a vector - x components cancel.

$\vec{E}_y = 2\cos\theta \frac{kQ}{r^2} - \frac{kQ}{r^2}$



$= 10.8\times10^{7}\,N/C$

[B]

(#10) $U = qV \qquad V = \frac{kq}{r} = \frac{(9\times10^{9}\,Nm^2/C^2)(1.6\times10^{-19}C)}{6\times10^{-15}m}$

$V = 240{,}000\,V$

$U = (1.6\times10^{-19}C)(240{,}000\,V) = 3.84\times10^{-14}\,J$

[D]

#11 $W = qV$ since q is the same for all and potential Difference V is the same for all, Work is the same for all

e

#12 ~~$V = Ex$~~ $E = \frac{kQ}{r^2}$

$$Q = \frac{Er^2}{k} = \frac{(3\times10^6\ V/m)(.1m)^2}{9\times10^9\ Nm^2/C^2} = 3.33\times10^{-6}\ C$$

E

#13 $V_1 = V_2$ $Q_{Total} = 6.5\times10^{-9}\ C.$

$$\frac{kQ_1}{r_1} = \frac{kQ_2}{r_2} \qquad Q_1 + Q_2 = Q_{Total}$$

$$\frac{Q_1}{.15m} = \frac{Q_2}{.1m} \qquad .1Q_1 = .15Q_2$$

$$Q_1 = 1.5Q_2$$

$$1.5Q_2 + Q_2 = 6.5\times10^{-9}C$$

$$2.5Q_2 = 6.5\times10^{-9}C$$

A $Q_2 = 2.6\times10^{-9}\ C$

(#14) Once the charged metal ball touches the can, the charge moves to the outside of the can. The only thing with a net charge is the outside of the can.

[A]

#15

$E = \frac{kq}{r^2}$

$r = \sqrt{\frac{kq}{E}} = \sqrt{\frac{(9\times10^9 Nm^2/C^2)(2\times10^{-3}C)}{3\times10^6 V/m}}$

$=$

$r = 2.45$

$D = 2\times r = \boxed{4.9m}$

$\boxed{B}$

#16

$V_1 = V_2$

$Q_1 + Q_2 = 25\times10^{-9}C$

$\frac{\cancel{k}Q_1}{R_1} = \frac{\cancel{k}Q_2}{R_2}$

$Q_1 R_2 = Q_2 R_1$

$Q_2 = \frac{Q_1 R_2}{R_1} = \frac{\left((25\times10^{-9}C) - Q_2\right) R_2}{R_1}$

$Q_2 = \left(25\times10^{-9} - Q_2\right)\left(\frac{12cm}{20cm}\right)$

$Q_2 = 15\times10^{-9}C - .6 Q_2$

$1.6 Q_2 = 15\times10^{-9}C$

$Q_2 = 9.38\times10^{-9}C$

$\boxed{B}$

#17 [A] - The potential Inside of a solid conductor is the same as the potential on the surface. ($E = 0_{inside} = -\frac{dV}{dr}$ so V is constant)

#18 $W_1 = 0$

$$W_2 = q_2 V_1 = \frac{(-2\times10^{-6}C)(9\times10^{+9} Nm^2/C^2)(6\times10^{-6}C)}{.08m}$$

$= -1.35$ J

[D]