Electricity test review problems sheet Name: - KEY - Per:___

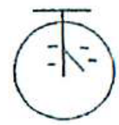
(1) UNITS:
a) Joule/Coulomb b) Coulomb/second c) Amp/second
d) Joule/second e) Watt*second f) Coulomb

Which is equal to a(n)

A) Volt (potential difference) : a) $[V] = [J/C]$ $V = E/q$
B) Joule (energy): e) $[J] = [W \cdot s]$ $E = P \cdot t$
C) Ampere (current): b) $[A] = [C/s]$ $I = \Delta q / t$
D) Amp-second: f) $[\frac{C}{s}] \cdot [s] = C$

(2) If an object (X) is positively charged and attracts another object (Y) then
a. Y must be negative b. Y can't be negative (c.) Y might be negative (or neutral)

Questions 3&4 refer to an electroscope which is charged negatively so that the moveable leaf is in the position shown.



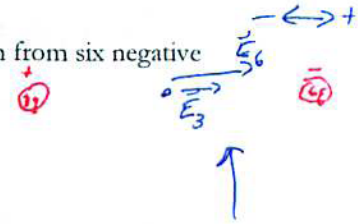
(3) Which one of the following actions would most likely cause the leaf to rise higher than its initial position and remain in a higher position?

a. Bringing a positive rod near the knob and then withdrawing the rod
b. Bringing a negative rod near the knob and then withdrawing the rod
c. Touching a positive rod to the knob and then withdrawing the rod
(d.) Touching a negative rod to the knob and then withdrawing the rod
e. Touching an uncharged conducting rod to the knob and then withdrawing the rod

(4) Which one of the following actions would most likely cause the leaf to rise higher than its initial position and return to its initial position as the rod is withdrawn?

a. Bringing a positive rod near the knob and then withdrawing the rod
(b) Bringing a negative rod near the knob and then withdrawing the rod
c. Touching a positive rod to the knob and then withdrawing the rod
d. Touching a negative rod to the knob and then withdrawing the rod
e. Touching an uncharged conducting rod to the knob and then withdrawing the rod

(5) Three positive elementary charges (electron charges) are in a lump placed 6.00×10^{-6} cm from six negative elementary charges also in a lump.



A) How strong is the force of attraction between them?

$$\vec{F} = \frac{K \cdot q_1 q_2}{r^2} = \frac{(8.99\times10^9 Nm^2/C^2)(3\times1.6\times10^{-19}C)(6\times1.6\times10^{-19}C)}{(6.00\times10^{-8}m)^2} = \boxed{1.15\times10^{-12}N}$$

B) How string is the electric field directly in between them? (Both point same dir, call this (+))

$$\Sigma\vec{E} = \vec{E}_1 + \vec{E}_2 = \frac{Kq_1}{r_1^2} + \frac{Kq_2}{r_2^2} = \frac{8.99\times10^9 Nm^2/C^2}{(3\times10^{-8}m)^2}\left((3+6)\times1.6\times10^{-19}C\right) = \boxed{1.44\times10^7 N/C}$$

(6) Two charges, q_1 and q_2, are separated by a distance d and exert a force on each other. What new force will exist if: (Write answers as ratio of New- Force/Old-Force)

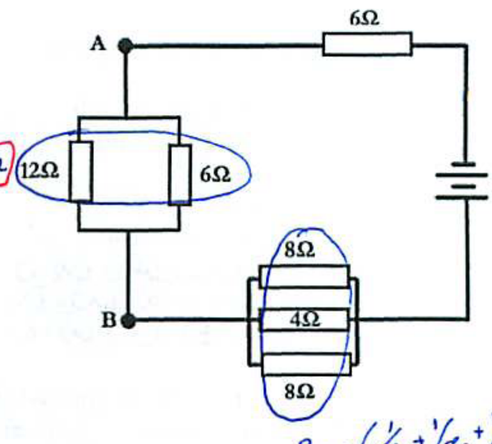
$$F = \frac{K\, q_1 \cdot q_2}{(r)^2}$$

a. q_1 is doubled? F_{new}/F_{old}= x 2
b. q_1 and q_2 are cut in half? F_{new}/F_{old} = x 1/4
c. d is tripled? F_{new}/F_{old} = x 1/9
d. d is cut in half ? F_{new}/F_{old} = x 4
e. q_1 is tripled and d is doubled? F_{new}/F_{old} = x 3/4

(7) How many excess electrons are on a particle charged -4.0×10^{-17} C? (show work)

$$(-4.0\times10^{-17}C)\left(\frac{1\,e.c.}{1.6\times10^{-19}C}\right) = 250\,e^-$$ (must be an integer)

(8) Refer to the circuit to the right



A) What is the resistance from A to B?

$R_{eq} = \left(\frac{1}{12\Omega} + \frac{1}{6\Omega}\right)^{-1} = \boxed{4\Omega}$

$R_{eq} = \left(\frac{1}{8\Omega} + \frac{1}{8\Omega} + \frac{1}{4\Omega}\right)^{-1} = 2\Omega$

B) What is the total resistance of the circuit?

$R_T = R_{eq_1} + R_{eq_2} + R_6 = 4\Omega + 2\Omega + 6\Omega = \boxed{12\Omega}$

C) What is the current through the battery?

$I_T = V_T / R_T = 36\text{v} / 12\Omega = 3\text{A}$

D) What is the voltage drop across the 12 ohm resistor? (find V for 12Ω/6Ω loop)

$V_\ell = I_\ell \cdot R_\ell = 3\text{A} \cdot 4\Omega = \boxed{12\text{V}}$ ← R_{eq} of loop

E) What is the power delivered to the 6 ohm resistor? (Between A + B)

$P = V^2/R = (12\text{v})^2 / 6\Omega = \boxed{24\text{w}}$

or find $I_6 = V/R = 12\text{v}/6\Omega = 2\text{A}$

then $P = I^2 R = (2\text{A})^2 \cdot 6\Omega = 24\text{w}$

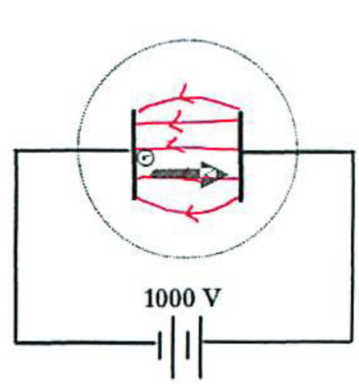
or $P = IV = 2\text{A} \cdot 12\text{v} = 24\text{w}$

(9) An electron is accelerated across a ~~2 mm~~ 20 cm gap which is at a potential difference of 1000 volts.

A) How strong is the electric field between the plates? Draw the E field lines on the diagram.

$E = V/d = 1000\text{v} / 0.20\text{m} = \boxed{5000\ \text{V/m}}$ or $5000\ \text{N/kg}$

B) How fast is the electron moving as it hits the positive plate?



use conservation of energy $1000\text{v} = 1000\ \text{J/c}$

$qV = \frac{1}{2} m v^2$

$v = \sqrt{2qV/m_e} = \sqrt{\frac{2 \cdot 1.6\times10^{-19}\text{c} \cdot 1000\ \text{J/c}}{9.11\times10^{-31}\text{kg}}}$ (charge of e^-)

$= \boxed{1.88\times10^{7}\ \text{m/s}}$