	Total	K+E	I+O
Student	34	15	19
Average	29.6/50	31.0/50	28.5/50
Best	49.5/50	49.5/50	45.0/50

11th Physics (2018 – 19)

(3rdQ, #1 Mini Test) 2-14-2019

Class	No.	Name Solutions

In calculation problems, describe equations clearly and systematically enough to show how to solve the problems. If not enough, you won't get any point.

Gravitational acceleration rate	$g = 9.80\ m/s^2$
Universal gravitational constant	$G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$
Coulomb's Law constant	$k = 8.99 \times 10^9\ N \cdot m^2/C^2$
Elementary Charge	$e = 1.60 \times 10^{-19}\ C$
Electron mass	$m_e = 9.11 \times 10^{-31}\ kg$
Proton mass	$m_p = 1.673 \times 10^{-27}\ kg$
Avogadro's number	$N_A = 6.022 \times 10^{23}\ mol^{-1}$

TABLE 1–4 Common Prefixes

Power	Prefix	Abbreviation
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr

4 pt/question x 13 questions =

(1-a) Explain the mechanism how rubbing an electrically neutral PVC rod with electrically neutral fur gives the rod a charge? (1-b) As the result of being charged, does the mass of the PVC rod increase, decrease, or stay the same in principle? Explain.

(1-a) Answer

When a PVC rod is rubbed with fur, electrons on the fur transfer to the PVC rod because of higher electronegativity of PVC, then the PVC rod gets charged negatively.

(1-b) Answer

The mass of the PVC rod increases as the result of charging because the PVC rod gains electrons: each particle of electron has a mass of 9.11×10^{-31} kg.

(73%)

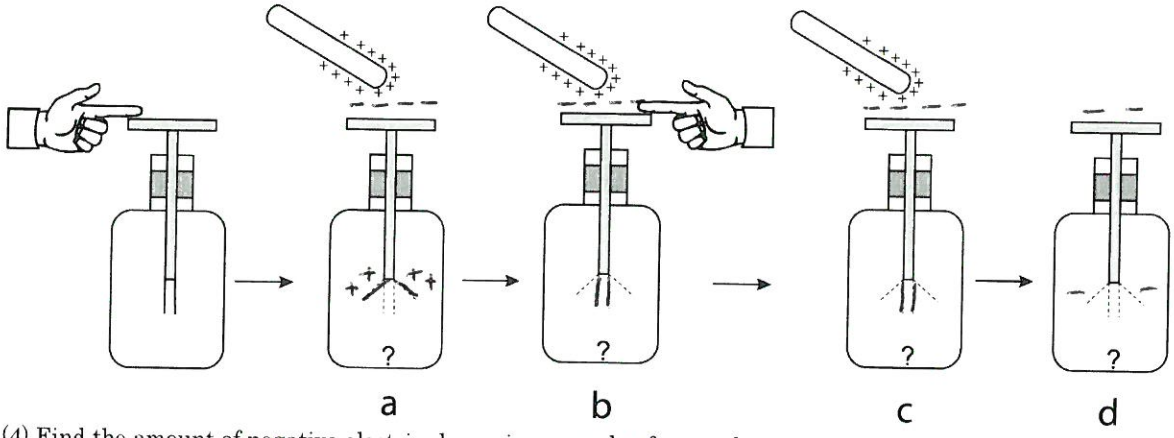
(2) Explain why a PVC rod that has been rubbed with fur attracts small polystyrene balls, small bits of paper or water stream, even though the balls, paper or water are uncharged?

(2) Answer

By rubbing with fur, a PVC rod is charged negatively. When the negatively charged PVC rod is brought near to a neutral insulator such as small polystyrene ball, small bit of paper or water, the atoms inside the insulator causes polarization, that is to say electrons in atoms move far from the rod and then the surface of the insulator gets positive. Then the negatively charged PVC rod attracts the positively charged insulators.

(58%)

(3) The following figure shows an experiment using an electroscope and positively charged glass rod. Draw the leaves, open or closed, and the distribution of charges in (a) to (d).



(70%)

(4) Find the amount of negative electric charge in one mole of neutral magnesium atoms.
(Equations)

$$1\ \text{mol} \times \frac{6.022\times10^{23}\ \text{atom}}{1\ \text{mol}} \times \frac{12\ \text{electrons}}{1\ \text{atom}} \times \frac{-1.60\times10^{-19}\ \text{C}}{1\ \text{electron}}$$

$$= -115.6 \times 10^{23-19}$$

$$= -1.156 \times 10^{6}\ (\text{C}) \longrightarrow -1.16 \times 10^{6}\ \text{C}$$

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr

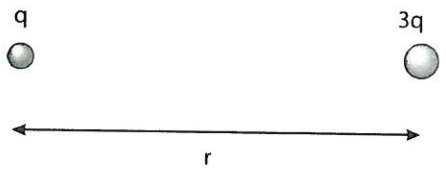
(4) Answer

-1.16×10^{6} C

(54%)

No minus −1.5

(5) The repulsive electric force between the positive point charges q and 3q has a magnitude of 2.4 N when the separation between the charges is r = 1.5 m. What is the magnitude of charge q?
(Equations)



$$F = k\frac{q \cdot 3q}{r^2} = \frac{3kq^2}{r^2}$$

$$\rightarrow q = r\sqrt{\frac{F}{3k}}$$

$$= 1.5\sqrt{\frac{2.4}{3 \times 8.99 \times 10^9}}$$

$$= 1.5 \times \sqrt{0.8899 \times 10^{-10}}$$

$$= 1.4150 \times 10^{-5}\ (C)$$

$$\rightarrow 1.4 \times 10^{-5}\ (C)$$

$$= 14\ \mu C$$

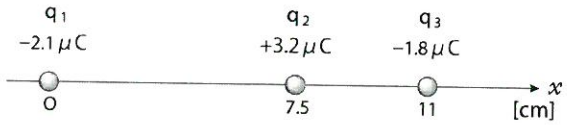
(5) Answer

14 μC

(75%)

1.4×10^{-5} C

(6) Three point charges lie on the x axis, q1 = −2.1 μC is at the origin, q2= +3.2 μC at x = 7.5 cm, and q3 = −1.8 μC is at x = 11 cm, as shown in the figure. What is the direction and magnitude of the total force exerted on q1?
(Equations)



$F_3 \longleftarrow \bullet \longrightarrow F_2$

$$F = F_2 - F_3$$

$$= k\frac{(2.1\mu)(3.2\mu)}{7.5^2\times10^{-4}} - k\frac{(2.1\mu)(1.8\mu)}{11^2\times10^{-4}}$$

$$= 8.99\times10^9 \times 2.1\times10^{-12}\times10^4 \times \left(\frac{3.2}{7.5^2} - \frac{1.8}{11^2}\right)$$

$$= 188.79 \times (0.05686 - 0.01488)$$

$$= 188.79 \times 0.04198$$

$$= 7.932 \longrightarrow 7.9\ (N)$$

$10.73 - 2.81$

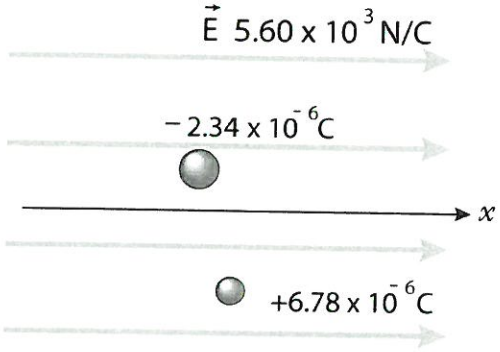
(6) Answer

7.9 N

to positive x axis

(41 %)

(7) In a certain region of space a uniform electric field has a magnitude of 5.60×10^3 N/C and points in the positive x direction. Find the magnitude and direction of the force this field exerts on a charge of (7-a) -2.34 μC and (7-b) + 6.78 μC.
(Equations)



(a) $\vec{F} = |q|E = 2.34 \times 5.6$

(a) $F = |q|E$

$= 2.34 \times 10^{-6} \times 5.60 \times 10^3$

$= 13.10 \times 10^{-3}$ N

$= 1.310 \times 10^{-2}$ N $\longrightarrow 1.31 \times 10^{-2}$ N

(b) $F = |q|E$

$= 6.78 \times 10^{-6} \times 5.60 \times 10^3$

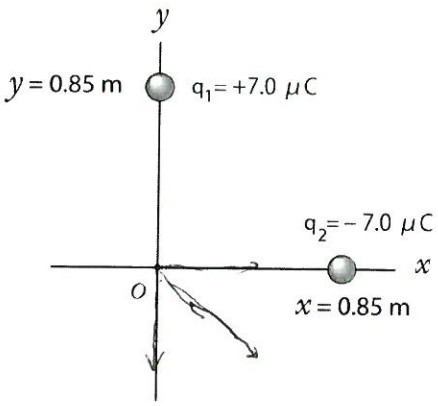
$= 37.968 \times 10^{-3}$

$= 3.7968 \times 10^{-2}$ N $\longrightarrow 3.80 \times 10^{-2}$ N

(7-a) Answer
1.31×10^{-2} N ~~opposite~~ To negative x axis
(7-b) Answer
3.80×10^{-2} N To positive x axis

(82%)

(8) An electric charge q1 = +7.0 μ C is placed on the y axis at y = 0.85 m. Anther charge q2 = −7.0 μ C is placed on the x axis at x = 0.85 m. Find the magnitude and direction of the total electric field at the origin due to the two charges.
(Equations)



$$E = \sqrt{2}\, k \frac{|7\times10^{-6}|}{r^2}$$

$$= \sqrt{2} \times 8.99 \times 10^{9} \times \frac{7\times10^{-6}}{0.85^2}$$

$$= 123.18 \times 10^{3}$$

$$= 1.2318 \times 10^{5}$$

$$\rightarrow 1.2 \times 10^{5} \ N/C$$

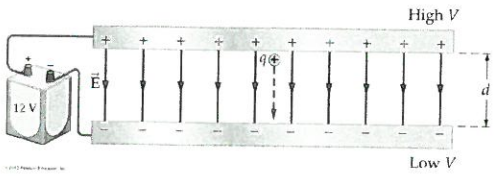
(8) Answer

1.2×10^{5} N/C

-45° from x-axis

(33%)

(9, 10) A uniform electric field is established by connecting the plates of a parallel-plate capacitor to a 12-V battery.
(9-a) If the plates have a separation of 0.85 cm, what is the magnitude of the electric field in the capacitor.?
(9-b) A charge of + 6.42 μ C moves from the positive plate to the negative plate. Find the change in electric potential energy for this charge.



(10) The charge is released from rest at the positive plate and reaches tha negative plate with a speed of 3.4 m/s. What is the mass of the charge?
(Equations)

(9-a) $E = \frac{\Delta V}{d} = \frac{12}{0.85\times10^{-2}} = 1412 \rightarrow 1400\ (V/m)$

(9-b) $\Delta U = q\Delta V = 6.42\times10^{-6}\times(-12)$

$= -77.04\times10^{-6}$

$= -7.7\times10^{-5}\ (J)$

(10) $\frac{1}{2}mv_f^2 = q\Delta V$

$m = \frac{2q\Delta V}{v_f^2}$

$= \frac{2\times6.42\times10^{-6}\times12}{3.4^2}$

$= 13.33\times10^{-6}$

$= 1.333\times10^{-5}$

$\rightarrow 1.3\times10^{-5}\ kg$

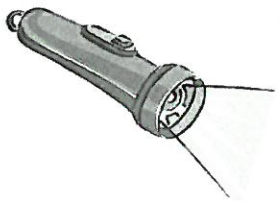
(9-a) Answer
1400 V/m
(9-b) Answer
-7.7×10^{-5} J

(47%)

(10) Answer
1.3×10^{-5} kg

(28%)

(11) A flash light bulb carries a current of 0.18A for 78 s. How many electrons flows through the bulb?
(Equations)



$$I = \frac{\Delta Q}{\Delta t}$$

$\Delta Q = 0.18 \times 78$ (C) $= 14.04$

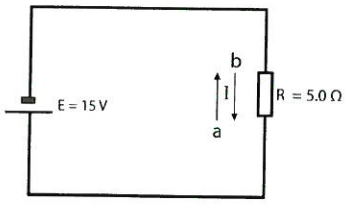
$$0.18 \times 78\ C \times \frac{1\ electron}{1.60 \times 10^{-19}\ C} = 8.775 \times 10^{19}\ electrons$$

$\rightarrow 8.8 \times 10^{19}$ electrons

(11) Answer

8.8×10^{19} electrons (40%)

(12) A resister R = 5.0 Ω is connected to a 15-V battery, as shown in the figure.
(12-a) Which direction does the current flow, a or b?
(12-b) How much current flows through the resistor?
(Equations)

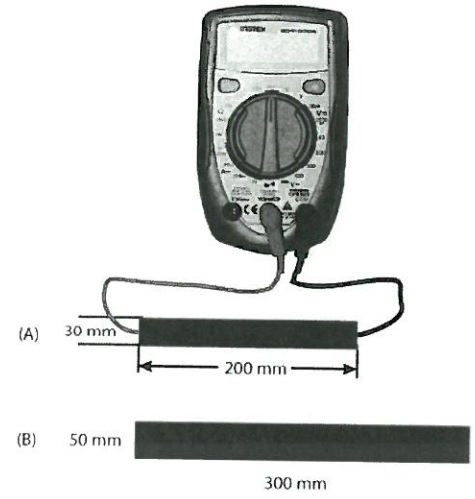


$$I = \frac{V}{R} = \frac{15}{5.0} = 3.0$$

(12-a) Answer a
(12-b) Answer 3.0 A

(81 %)

(13) In Physics Lab, you are measuring the resistances of various shapes of conductive paper. A piece of paper (A), 30mm x 200mm, shows 320 kΩ. Predict the resistance of the sample (B) with the size of 50mm x 300 mm.
(Equations)



$320\,(k\Omega) \times \frac{300}{200} \times \frac{30}{50}$

$= 288\,(k\Omega) \longrightarrow 290\,(k\Omega)$

(13) Answer
290 kΩ

(57%)

Opinions