	Total	K+E	I+O
Student	35	16	19
Average	26.3/50	25.5/50	27.0/50
Best	47.0/50	41.5/50	47.0/50

11th Physics (2018 – 19)

(3rdQ, #2 Mini Test)

Class	No.	Name Solutions

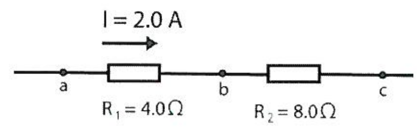
In calculation problems, describe equations clearly and systematically enough to show how to solve the problems. If not enough, you won't get any points.

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
Coulomb's Law Constant	$k = 8.99 \times 10^{9}$ N・m²/C²
Universal Gravitational Constant	$G = 6.67 \times 10^{-11}$ N・m²/kg²
Avogadro's Number	$N_A = 6.022 \times 10^{23}$ mol⁻¹
Magnetic Permeability of Free Space	$\mu_0 = 4\pi \times 10^{-7}$ T・m/A

4 pt/question x 13 questions = 52 pt Max 50 pt

／[Total 50 pt]

(1) A 4.0 Ω resistor and 8.0 Ω resistor are connected in series, as shown in the figure. The current through the 4 Ω resistor is 2.0 A.



(1-a) What is the current through the 8.0 Ω resistor?

(1-b) What is the potential difference (voltage) between the points, b and c?

(Equations)

a) 2.0 A

b) $V = iR_2 = 2.0 \times 8.0 = 16$ [V]

(1-a) Answer	2.0 A
(1-b) Answer	16 V

(62%)

(2) An oil heater operates on a 120V. The power consumed by the heater is 1600W (1.6×10^3 W).

(2-a) What is the current in it?

(2-b) When the heater operates during 12 hours, find the electric energy.

(Equations)

(a) $P = VI \quad I = \frac{P}{V} = \frac{1600}{120} = 13.3 \longrightarrow 13$

(b) $W = Pt = 1600\ W \times 12\ hr = 19.2 \times 10^3\ W\,hr \Rightarrow 19\ kWh$

$(19.2\ kWh = 19.2 \times 10^3 \times 3600 = 6.91 \times 10^7$

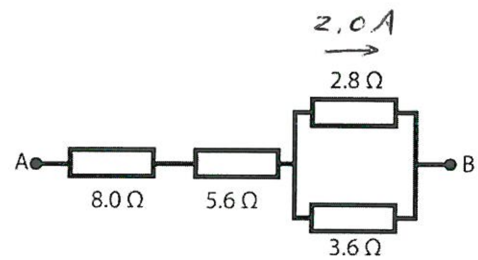
$\longrightarrow 6.9 \times 10^7\ J)$

(2-a) Answer	13 A
(2-b) Answer	19 kW·h

(61%)

or 6.9×10^7 J

(3) In the diagram at the right, the current through the 2.8 Ω resistor is 2.0A. What is the current through the 3.6 Ω resistor?
(Equations)



$V = iR$

$= 2.0 \times 2.8$

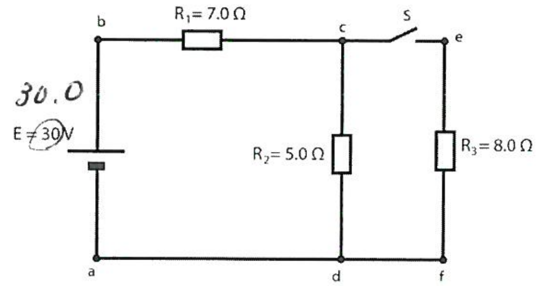
$= 5.60\ V$

$i = \frac{V}{R} = \frac{5.60}{3.6} = 1.55 \longrightarrow 1.6$

(3) Answer
1.6 A

(57%)

In the questions, (4) and (5), consider the circuit shown, where the potential at the point "a" is assumed as 0 V.



When the switch S is open, find the followings:
(4-a) The potential of the point "c".
(4-b) The current through the 5.0 Ω resistor R_2.
(Equations)

$R = 7.0 + 5.0 = 12.0$

$i = \frac{E}{R} = \frac{30}{12} = 2.50$

(b) 2.5A

(a) $2.5 \times 5.0 = 12.5 \rightarrow 12$ [V]

(4-a) Answer
12 V
(4-b) Answer
2.5 A

(50%)

When the switch S is closed, find the followings:
(5-a) The potential of the point "e".
(5-b) The current through the 5.0 Ω resistor R_2.
(Equations)

(a) $\frac{1}{R'} = \frac{1}{5.0} + \frac{1}{8.0}$ $R' = 3.077$ [Ω]

$R = 7.0 + 3.077 = 10.077$ [Ω]

$i = \frac{E}{R} = \frac{30}{10.077} = 2.9771$ [A]

$V_1 = iR_1 = 2.9771 \times 7.0 = 20.84$

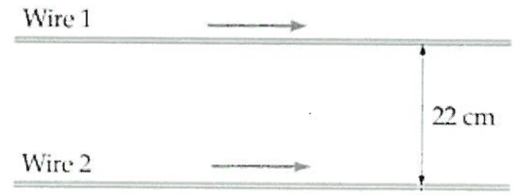
$30.0 - 20.84 = 9.16 \rightarrow 9.2$

(b) $I = \frac{V_2}{R_2} = \frac{9.16}{5.0} = 1.83 \rightarrow 1.8$ [A]

(5-a) Answer
9.2 V
(5-b) Answer
1.8 A

(41%)

(6) Two horizontal wires, Wire-1 and Wire-2, 22 cm apart carry currents I1 = 2.5 A and I2 = 5.5 A, respectively, flowing to the right. Find the direction and magnitude of the magnetic field halfway between the wires.



⊙ out of page : positive

$$B_1 = -\frac{\mu_0}{4\pi}\frac{I_1}{r} = -2 \times 10^{-7} \times \frac{2.5}{0.11}$$

$$B_2 = \frac{\mu_0}{4\pi}\frac{I_2}{r} = 2. \times 10^{-7} \times \frac{5.5}{0.11}$$

$$B = B_1 + B_2 = \frac{2\times10^{-7}}{0.11}(5.5 - 2.5)$$

$$= 54.54\times10^{-7} \longrightarrow 5.5\times10^{-6}\,[T]$$

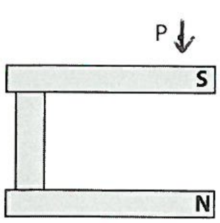
(6) Answer

5.5×10^{-6} T out of page (37%)

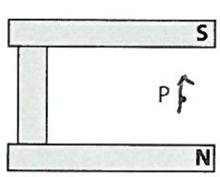
(7-a) ~ (7-d) Answer
Draw an arrow at the point P in the figure.

(80%)

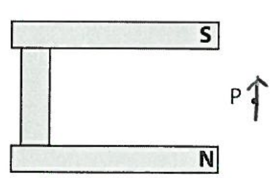
(7) U-shape or horse-shoe magnet creates a magnetic field around it. Show the direction of the magnetic field at the location P by drawing an arrow



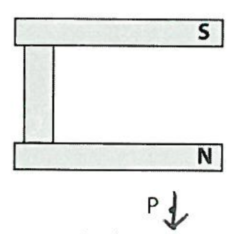
(7-a)



(7-b)

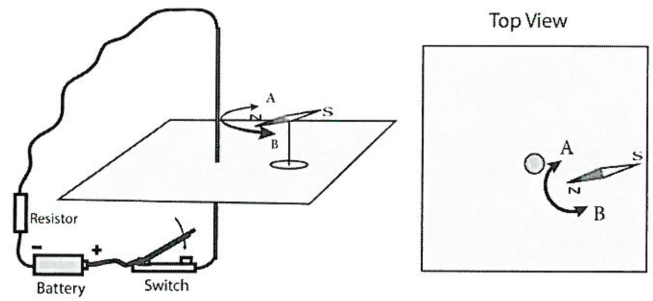


(7-c)

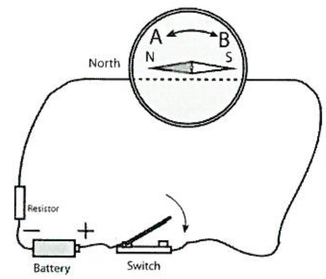


(7-d)

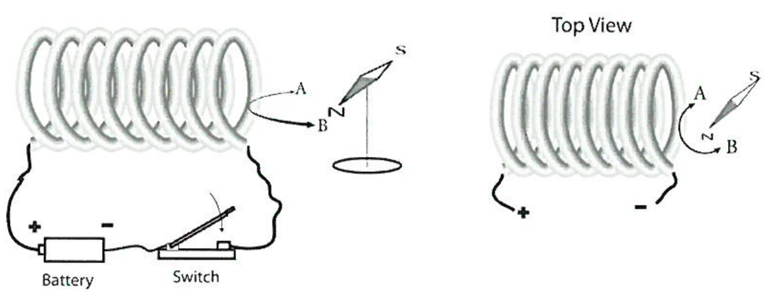
(8) When the current is applied in wire, the north pole of the compass moves in the direction, A or B. Answer A or B.
(Equations)



8-a



8-b



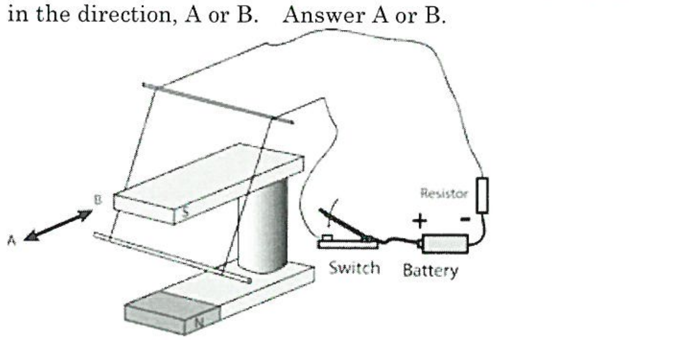
8-c

Answer

(8-a)	A
(8-b)	B
(8-c)	B
(8-d)	B

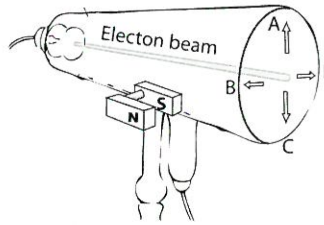
(80%)

(8-d) When the current is applied in wire, the metal rod moves in the direction, A or B. Answer A or B.



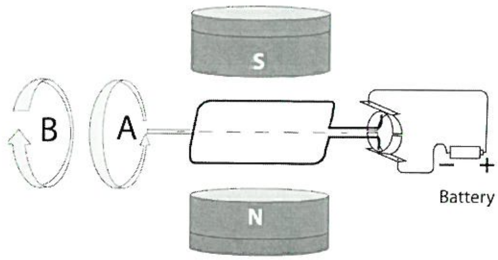
(8-d)

(9-a) Electron beam is shown in the Crooks Tube. A magnet is brought near the tube as shown. In which direction does the electron beam move, A, B, C or D?



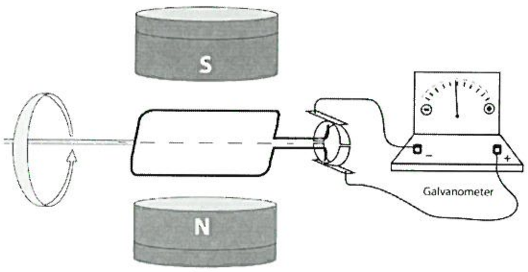
(9-a)

(9-b) The figure shows a motor. How does it rotate, in the direction **A** or in the direction **B**?



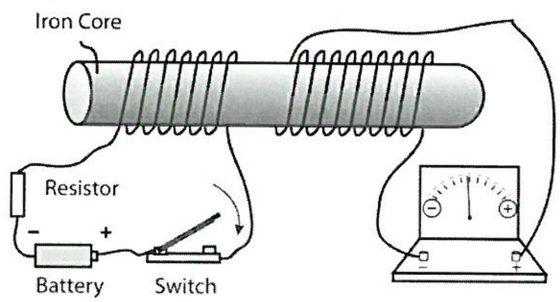
(9-b)

(9-c) The figures show generators. The coil rotates around the rotating rod in the direction shown. the galvanometer shows a swing to the positive or negative side. Answer "positive" (+) or "negative" (−).



(9-c)

(9-d) The instance the current is applied in the coil at the left, the galvanometer shows a swing to the positive or negative side. Answer "positive" (+) or "negative" (−).



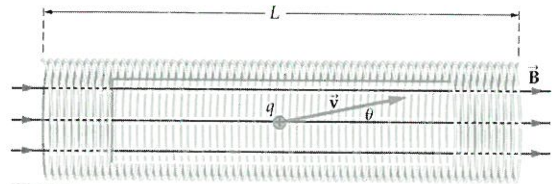
(9-d)

Answer

(9-a)	A
(9-b)	B
(9-c)	+
(9-d)	−

(63%)

(10) A solenoid (coil) is 20.0 cm long, has 200 loops, and carries of 3.25 A.



(10) Find the magnitude of the magnetic field inside the solenoid.

(11) Now a 15.0-μ C charged particle is moving at 1050 m/s inside the solenoid at an angle of 11.5° relative to the solenoid axis. Find the magnitude of the force on the particle.

(10)

$$B = \mu_0 \left(\frac{N}{L}\right) I = 4\pi \times 10^{-7} \times \frac{200}{0.200} \times 3.25$$

$$= 40846 \times 10^{-7}$$

$$\Rightarrow 4.08 \times 10^{-3}\ [T]$$

(11) $F = qvB\sin\theta$

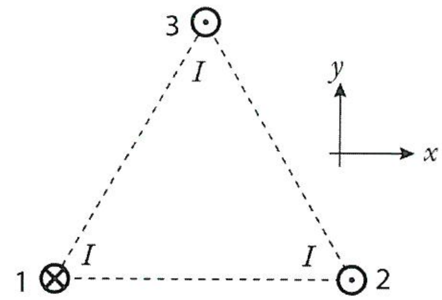
$$= 15.0 \times 10^{-6} \times 1050 \times 4.0846 \times 10^{-3} \sin 11.5^\circ$$

$$= 1.283 \times 10^{-5} \longrightarrow 1.28 \times 10^{-5}\ [N]$$

(10) Answer
4.08×10^{-3} T (42%)

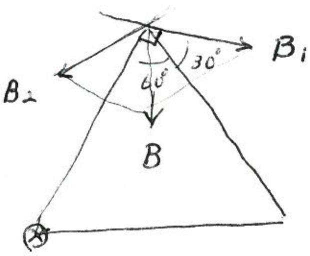
(11) Answer
1.28×10^{-5} N (31%)

(12) The three wires shown in the figure are long and straight, placed at each corner of an equilateral triangle and they each carry a current of the same magnitude, I. ~~The currents in wires 1 and 3 are out~~ of the page; the current in wire 2 is into the ~~page.~~ What is the direction of the magnetic force experienced by wire 3?

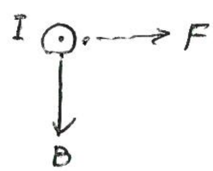


The current is shown in the figure

magnetic field



force

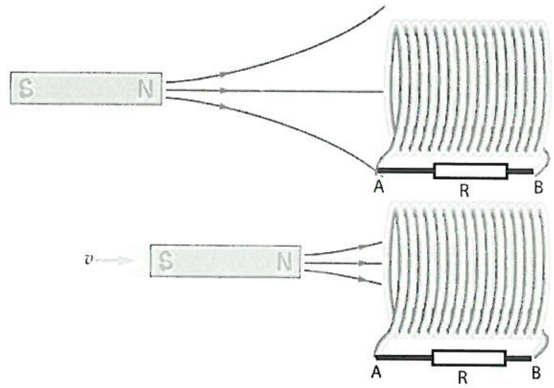


(12) Answer

plus x-axis

(6%)

(13) A bar magnet is moved rapidly toward a 55-loop coil of wire. As the magnet moves, the magnetic flux through the coil increases from $2.8 \times 10^{-5}\ T \cdot m^2$ to $5.1 \times 10^{-3}\ T \cdot m^2$ in 2.1s. The $4.6\,\Omega$-resistance is connected to the coil as shown in the figure.



(13-a) What is the magnitude of induced emf?

(13-b) What is the magnitude and direction flowing the resistance?

(a) $\mathcal{E} = N \left| \frac{\Delta \phi}{\Delta t} \right|$

$= 55 \ \frac{5.10 \times 10^{-3} - 2.8 \times 10^{-3}}{2.1}$

$= 0.133 \longrightarrow 0.13$ [V]

(b) $i = \frac{\mathcal{E}}{R} = \frac{0.133}{4.6} = 0.0289$

$\rightarrow 0.029$ [A]

Direction B → A

(13-a) Answer
0.13 V

(48%)

(13-b) Answer
0.029 A B → A

 3/7/2019 By Tohei Moritani