Omin Calista's copy

FEDERAL UNIVERSITY OYE-EKITI
DEPARTMENT OF PHYSICS
B.Sc. Second Semester Examination 2016/2017 Academic Session

PHY102: General Physics 11 **3 credit units** **Time allowed: $1\frac{1}{2}$ hours**

Instruction: Tick your answers on the answer sheet.

1.Filtering out unwanted signals is one of the application of ______

A. Resistor B. Capacitor C. Transistor D. Inductor E. Insulator

2. The higher the self-inductance of a coil

A. The lesser it weber-turns
B. The lower the emf induced
C. The greater the flux produced by it
D. The longer the delay in establishing steady current through it
E. A and B

* 3.The electron and proton of a hydrogen atom are separated (on the average) by a distance of approximately $5.3 \times 10^{-11} m$. Find the magnitudes of the electric force.

A. $5.3 \times 10^{-8} N$ B. $9.6 \times 10^{-8} N$ C. $8.2 \times 10^{-8} N$ D. $11.4 \times 10^{-6} N$ E. $3.3 \times 10^{-9} N$

* 4.Calculate the cyclotron frequency of an electron of mass $9 \times 10^{-31} kg$ and charge $1.6 \times 10^{-19} C$ circulating a plane at right angles to a uniform magnetic field B of magnitude $2.0 \times 10^{-4} T$.

A. $3.2 \times 10^{-23} Hz$
B. $5.72 \times 10^{-30} Hz$
C. $5.59 \times 10^{6} Hz$
D. $1.82 \times 10^{-34} Hz$
E. $1.59 \times 10^{6} Hz$

+ 5.A positive test charge of $3.0 \times 10^{-8} C$ is placed in a place where it experiences a force $f = 6.0 \times 10^{-8} N$. Calculate the electric field the charge experiences

A. 2 N/C B. 18 N/C C. 9 N/C D. 6 N/C E. 8 N/C

6.The total electric flux over any closed surface is

A. ε_0 B. $\frac{q^2}{\varepsilon_0}$ C. $\frac{\varepsilon_0}{q}$ D. $\frac{q}{\varepsilon_0}$ E. $q\varepsilon_0$

7.The electric potential at points in an xy plane is given by $V = 2x^2 - 3y^2$ The magnitude and direction of the electric field at point (3.0 m, 2.0 m) respectively are:

A. $25 Vm^{-1}$ and $45°$
B. $17 Vm^{-1}$ and $135°$
C. $38 Vm^{-1}$ and $150°$
D. $42 Vm^{-1}$ and $35°$
E. $47 Vm^{-1}$ and $75°$

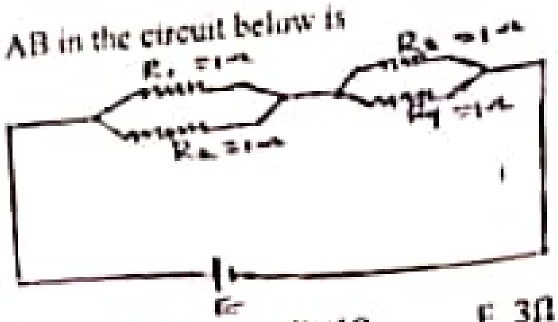
as the area of a vector approaches a differential limits dA, the equation becomes $\phi = \int E \cdot dA$

*Electric flux is the number of electric field lines that passes through a given surface.

The total electric flux (ϕ) through a closed surface is equal to the total net charge (q). inside the surface divided by the permitti[vity] ε_0

$\phi = \frac{q}{\varepsilon_0}$ $\phi = \frac{q}{\varepsilon_0}$

8. The resistance across AB in the circuit below is



A. 1Ω B. 2Ω C. 0.5Ω D. 4Ω E. 3Ω

9. A magnetic field is given by the expression $\vec{B} = axz\hat{i} + byz\hat{j} + c\hat{k}$, use differential form of Gaussian magnetic field to find 'a'

A. $a = b$ B. $a = c$ C. $a = -b$ D. $a = -c$ E. $a = 2b$

10. The magnetic flux Φ_B through the loop is given by ____________

A. $\oint B \cdot d\vec{A}$ B. $\oint B \cdot dE$ C. $\nabla \cdot D$ D. $\nabla \cdot E$ E. $\oint E . dD$

$E = \frac{1}{2}LI^2$

11. How much energy is stored in a 20 mH coil when it carries a current of 0.2 A

A. $4 \times 10^{-3}\,J$ B. $4 \times 10^{-4}\,J$ C. $0.4 \times 10^{-4}\,J$ D. $6.4 \times 10^{-4}\,J$ E. $7 \times 10^{-3}\,J$

20 mH
0.02H
$\frac{1}{2}(0.02)(0.2)^2$
$= 4\times10^{-4}$ J

12. A point charge $-10^{n}C$ is situated in air at the origin of a rectangular coordinate system, a second charge situated at a distance of 50cm from the origin. Calculate the force on the second charge

A. $+3.6\,N$ B. $-3.6\,N$ C. $-10\,N$ D. $+10\,N$ E. $-4.6\,N$

13. The magnetic flux through a loop increases according to the relation $\Phi = 6t^2 + 7$ in milliweber and in seconds. Find the magnitude of the emf induced in the loop when t = 2seconds

A. 0.024V B. 2400V C. 0.020V D. 200V E. 0.094V

$\frac{24}{1000}$
0.024

14. An air cored coil of self-inductance L has N turns of fine insulated copper wire wound on a conductor of cross-sectional area A. If the area and number of turns are doubled and the core is a medium of relative permitivity 1000, the self-inductance of the coil, will be

A. 8000 L B. 4000 L C. $8 \times 10^{-3}L$ D. $8 \times 10^{-2}L$ E. L

15. The $\int_0^t i\,dt$ gives ____________

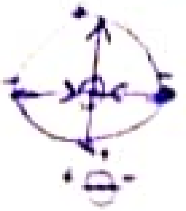
A. Resistance B. Quantity of charges C. Current D. Potential difference E. Field

16. A particle initially moving north in a vertically downward magnetic field is deflected toward east. What sign of the charge on the particle?

A. Positive B. Negative C. Neutral D. Electron E. Oscillatory

17. The total electric flux through a closed surface depends

A. On the location of the charge only
B. On the shape of the closed surface only
C. On the value of the charge only
D. On both the location of the charge and the shape of the surface
E. All of the above



$E = \frac{F}{q}$

18.Two identical conducting small spheres are placed with their centres 0.300 m apart. One is given a charge of 12.0 nC and the other a charge of -18.0 nC. Find the electric force exerted by one sphere on the other.

A. $8.5 \times 10^{4} N$ B. $6.5 \times 10^{-4} N$ C. $5.5 \times 10^{-7} N$ D. $7.1 \times 10^{-6} N$ E. $1.5 \times 10^{-3} N$

19.An infinite nonconducting sheet has a surface charge density $\sigma = 0.10$ $\mu C/m^2$ on one side. How far apart are the equipotential surfaces whose potentials differ by 50 V?

A. 76 mm B. 56 mm C. 88 mm D. 95 mm E. 68mm

20.A 100 turn coil whose resistance is 6 Ω encloses an area of 80 cm^2. How rapidly should a magnetic field to its axis change in order to induce a current of 1 mA in the coil?

A. 0.0075 Ts^{-1} B. 75.0 Ts^{-1} C. 0.75 Ts^{-1} D. 0.0075 V E. 0.0085 Ts^{-1}

21.A capacitor of capacitance 3.0 μF is subjected to a 2000 V potential difference across its terminal. Calculate the energy stored in the capacitor

A. 18000 J B. 6 J C. 6000 J D. 1.5 J E. 150 J

22.Object A has a charge of +2 μC and object B has a charge of +6 μC. Which statement is true about the forces on the objects?

A. $F_{AB} = -3F_{BA}$ B. $F_{AB} = -F_{BA}$ C. $3F_{AB} = -F_{BA}$ D. $F_{AB} = 3F_{BA}$ E. $F_{AB} = F_{BA}$

23.Mutual inductance between two magnetically coupled coil depend on

A. Permeability of the coil
B. The number of turns
C. Cross-sectional area of their common core
D. All of the above
E. A and B

24.Two electric fields $E_1 = 3.00$ N/C and $E_2 = 2.00$ N/C at right angles in a plane. Calculate the net electric field direction at a point P in the plane.

A. 3.61 N/C and 33.7°
B. 3.61 N/C and 42°
C. 5 N/C and 33.7°
D. 5 N/C and 42°
E. 5.61 N/C and 22.7°

25.A coil of 160 turns has a radius of 1.90 cm. What value of current result in magnetic dipole moment of 2.30 Am^2?

A. $1.134 \times 10^{-2} A$ B. 0.0805 A C. 12.78 A D. 1.3 A E. 5.67 A

26.Which of the following formula is incorrect?

A. $\sigma = \frac{\varepsilon}{J}$ B. $\rho = \frac{E}{J}$ C. $E = \frac{V}{l}$ D. $R = \frac{\rho l}{A}$ E. $\sigma = \frac{EA}{I}$

27.For a given configuration of charges, a set of points where the electric potential V (r) has a given value which it takes no work to move a charged particle from one point to another is known as

A. Inter parallel potential surface
B. Interpolar potential surface
C. Equipotential surface
D. Semi potential surface

28.Two +2 μC point charges are located on the x-axis. One is at $x = 1.00$ m and the other is at $x = -1.00$ m. Determine the electric field on the y-axis at $y = 0.500$ m.

1ev = 1.6×10^{-19} C

$M_{21} = C_2 / C_1$

$M_{12} \frac{1}{C_2}$

$M_{12} = M_{21}$

$C_{..} - C_1$

A. $4.2 \times 10^{6}\ N/C$
B. $6.3 \times 10^{4}\ N/C$
C. $1.6 \times 10^{4}\ N/C$
D. $4.7 \times 10^{4}\ N/C$
E. $6.2 \times 10^{6}\ N/C$

29. Calculate the inductance of a solenoid containing 250 turns if the length of the solenoid is 20.0cm and its sectional area is $400 \times 10^{-4} m^2$
A. 0.0157 mH B. 15.7 mH C. 0.157 mH D. 0.157 H E. 18.7 mH

30. Which of the following mathematical expression is a Lorentz equation for magnetic field.
A. $\vec{V}F = qV \times \vec{B}$ B. $F_B = qB \times \vec{V}$ C. $F = qB \times \vec{V}^2$ D. $F = q\vec{V} \times \vec{B}$ E. $F_B = qAB \times \vec{V}$

31. How much work is required to carry an electron from the positive terminal of a 12-V battery to the negative terminal?
A. $1.9 \times 10^{-18} J$
B. -1.9×10^{-18}
C. $1.6 \times 10^{-17} J$
D. $1.2 \times 10^{-18} J$
E. $1.0 \times 10^{-17} J$

32. Calculate the conductivity and resistance of a given uniform wire of length 2.0 m and resistivity $5.4 \times 10^{-7}\ \Omega/m$ if the cross-sectional area of the wire is $9.5 \times 10^{-3}\ cm^2$
A. $1.85 \times 10^{6}\ \Omega^{-1}m^{-1}$, 1.44 Ω
B. $3.70 \times 10^{6}\ \Omega^{-1}m^{-1}$, 1.44 Ω
C. $3.70 \times 10^{6}\ \Omega^{-1}m^{-1}$, 2.28 Ω
C. $1.85 \times 10^{6}\ \Omega^{-1}m^{-1}$, 2.28 Ω
E. $1.6 \times 10^{6}\ \Omega^{-1}m^{-1}$, 3.14 Ω

33. The equation $E = q(E + V \times B)$ is termed as ____________
A. Magnetic Forces
B. Electric Force
C. Lorentz Force Law
D. Force Square Law
E. Electromagnetic Force

34. A coil of 10 turns and cross-sectional area $5\ cm^2$ is at right angles to a flux density $2 \times 10^{-2} T$ which is reduced to zero in 10 s. Find the induced emf.
A. $1.0 \times 10^{-5}\ V$
B. $10 \times 10^{-5}\ V$
C. $100 \times 10^{-5}\ V$
D. $1.0 \times 10^{-5}\ A$
E. $13 \times 10^{-5}\ V$

35. Two large, parallel conducting plates are 12 cm apart and have charges of equal magnitude and opposite sign on their facing surfaces. An electrostatic force of $3.9 \times 10^{-2}\ N$ acts on an electron placed anywhere between the plates (Neglect fringing). The electric field at the position of the electron and the potential difference between plates respectively are:
A. $2.4 \times 10^{4}\ Vm^{-1}$ and $2.9 \times 10^{3}\ V$
B. $3.5 \times 10^{4}\ Vm^{-1}$ and $2.7 \times 10^{3}\ V$
C. $2.5 \times 10^{5}\ Vm^{-1}$ and $2.5 \times 10^{2}\ V$
D. $4.5 \times 10^{3}\ Vm^{-1}$ and $5.0 \times 10^{3}\ V$
E. $6.4 \times 10^{4}\ Vm^{-1}$ and $5.9 \times 10^{3}\ V$

36. An electric field with a magnitude of 160 N/C exists at a spot that is 15 cm away from a charge. At a place 26 cm away from this charge, calculate the electric field strength.

A. 53.3 N/C B. 50 N/C C. 36 N/C D. 18 N/C E. 19 N/C

37.Which of the following circuit element stores charges energies in terms of magnetic field.

A. Condenser
B. Inductance
C. Variable resistor
D. Resistance
E. Reactance

38.Which of the following statements is not correct about the resistance of a wire?

A. The length of the increases as the resistance increases
B. The cross-sectional area increases as the resistance increases
C. Temperature increases as the resistance increases
D. The nature of material does not affect the resistance of a wire
E. None

39.If the electric field in the region between two deflecting plates of a cathode ray oscilloscope is 30,000 N/C. Calculate the force on an electron in the region.

A. 4.8×10^{-18} N
B. 2.8×10^{-18} N
C. 4.8×10^{-15} N
D. 2.8×10^{-15} N
E. 6.8×10^{-18} N

40.The electric potential difference between the ground and a cloud in a particular thunderstorm is 1.2×10^9 magnitude of the change in potential energy (in multiples of the electron-volt) of an electron that moves between the ground and the cloud is:

A. 4.8 GeV B. 1.2 GeV C. 2.4 GeV D. 3.6 GeV E. 6.2 GeV

41.One of the following types of waves propagates via a material medium

A. Sound wave
B. Both transverse and longitudinal waves
C. Traverse wave only
D. None of the above
E. Atomic wave

42.Three point charges $q_1 = -4\ \mu C, q_2 = +3\ \mu C$ and $q_3 = -7\ \mu C$. If the separation between q_1 and q_2 is 20 cm and the separation between q_2 and q_3 is 15 cm, calculate the net force on q_2.

A. 8.4 N/C
B. 5.7 N/C
C. -2.7 N/C
D. 11.1 N/C
E. 7.4 N/C

43.A transformer connected to a 120 V AC power line has 200 turns in its primary winding and 50 turns secondary winding. The secondary is connected to a 100 Ω light bulb. How much current is drawn from the power line?

A. 0.075 Ω B. 0.075 A C. 0.0075 A D. 0.065 A E. 0.56 A

44. A test charge of $+3\ \mu C$ is at a point P where an external electric field is directed to the right and has a magnitude of $4 \times 10^6\ N/C$. If the test charge is replaced with another test charge of $-3\ \mu C$, the external electric field at P is ________

A. Unaffected
B. Reverses direction
C. Changes away in way that cannot be determined
D. Goes up and down
E. Reversed in magnitude

45. A core coil has a length of $20\ m$. The inductance of the coil is $6\ mH$. If the core length is doubled and the other properties remain the same. What is the inductance of the coil?

A. $3\ mH$ B. $12\ mH$ C. $24\ mH$ D. $43\ mH$ E. A and B

46. Five point charges are enclosed in a cylindrical surface S. If the values of the charges are $q_1 = +3\ nC, q_2 = -2\ nC, q_3 = -2\ nC, q_4 = +4\ nC, q_5 = -1\ nC$. Find the total flux through S.

A. $200\ Vm$ B. $226\ Vm$ C. $260\ Vm$ D. $700\ Vm$ E. $760\ Vm$

47. A circular current wire $6.5\ cm$ in diameter has 12 turns and carries a current of $2.7\ A$. The coil is in a region where the magnitude of the field is $0.56\ T$. What is the maximum torque on the flux?

A. $0.0698Nm$ B. $0.6989Nm$ C. $0.27353Nm$ D. $0.19698\ Nm$ E. $1.25Nm$

48. The $\int J\ dA$ represents ____ where J is the current density and A is the area.

A. Resistance
B. Potential difference
C. Electric current
D. Resistivity
E. Field

49. The electric potential energy of two electrons separated by $20\ nm$ situated in a free space is ____________

A. $1.15 \times 10^{-19}\ J$
B. $2.75 \times 10^{-19}\ J$
C. $1.725 \times 10^{-19}\ J$
D. $6.95 \times 10^{-19}\ J$
E. $4.75 \times 10^{-19}\ J$

50. An electron moves around a fixed proton at a distance of $5.29 \times 10^{-11}\ m$. Calculate the potential the proton creates at this distance.

A. $-13.6\ V$ B. $+6.8\ V$ C. $+27.2\ V$ D. $+13.6\ V$ E. $+6.8\ V$

PHY 102 :- Solution to past Questions

1. C

2. C

$\uparrow \boxed{\phi = LI} \uparrow$

3. $f = \frac{k|q_1||q_2|}{r^2}$

$r = 5.3 \times 10^{-11}\,m.$

q_1 (electron) $= -1.602 \times 10^{-19}$

q_2 (proton) $= 1.602 \times 10^{-19}$

$k = 8.99 \times 10^9\, Nm^2/C^2$

$$f = \frac{8.99 \times 10^9 \times |1.602 \times 10^{-19}| \times |-1.602 \times 10^{-19}|}{(5.3 \times 10^{-11})^2}$$

$$f = \frac{8.99 \times 10^9 \times 1.602 \times 10^{-19} \times 1.602 \times 10^{-19}}{5.3^2 \times 10^{-22}}$$

$$f = \frac{(8.99 \times 1.602 \times 1.602) \times 10^{9-19-19}}{28.09 \times 10^{-22}}$$

$$f = \frac{23.07197196 \times 10^{-29}}{28.09 \times 10^{-22}}$$

$f = 0.8214 \times 10^{-29--22} = 0.8214 \times 10^{-29+22}$

$f = 0.8214 \times 10^{-7} = 8.214 \times 10^{-8} \simeq \underline{\underline{8.2 \times 10^{-8}}}$ C

4) $m = 9 \times 10^{-31}\,kg \quad q = 1.6 \times 10^{-19}\,C \quad B = 2.0 \times 10^{-4}\,T$

$f = ?$

$$f = \frac{qB}{2\pi m} = \frac{1.6 \times 10^{-19} \times 2.0 \times 10^{-4}}{2 \times \pi \times 9 \times 10^{-31}}$$

$$f = \frac{1.6 \times 2.0 \times 10^{-19-4}}{2\pi \times 9 \times 10^{-31}} = \frac{3.2 \times 10^{-23}}{18\pi \times 10^{-31}} = \frac{3.2}{18\pi} \times 10^{-23--31}$$

$$f = \frac{3.2}{18\pi} \times 10^{-23+31} = \frac{3.2}{18\pi} \times 10^{8} = 0.0566 \times 10^{8}$$

$f = 5.66 \times 10^6$ Hz Similar to answer C

5) $q = 3.0 \times 10^{-8}\,C \quad f = 6.0 \times 10^{-8}\,N \quad E = ?$

$$E = \frac{f}{q} = \frac{6.0 \times 10^{-8}}{3.0 \times 10^{-8}} = 2 \times 10^{-8+8} = \underline{2}\, N/C \quad A$$

6) $\frac{q}{\varepsilon_0}$ D

7. $V = 2x^2 - 3y^2 \quad (3.0m, 2.0m)$

electric field $E = (\frac{dv}{dx}i + -\frac{dv}{dy}j)$

$E = 4x + -6y$ at $(3.0, 2.0)$

$E = 4(3) + -6(2) = 12 + -12$

$E = \sqrt{|12|^2 + |-12|^2} = \sqrt{144 + 144} = \sqrt{288} = 16.97$

$E \simeq \underline{17 Vm^{-1}}$ B

8) resistance across AB in circuit

R_1 is parallel to R_2 , R_3 is parallel to R_4

$R_{12} = \frac{1 \times 1}{1+1} = \frac{1}{2} \qquad R_{34} = \frac{1 \times 1}{1+1} = \frac{1}{2}$

R_{12} and R_{34} are connected in series

$R_{1234} = R_{eq} = \frac{1}{2} + \frac{1}{2} = \underline{1\Omega}$ A

10) magnetic flux through the loop is the product of magnetic field and area

$\phi_B = \oint B \cdot d\vec{A}$ A

ϕ_B → magnetic flux, B → magnetic field, $d\vec{A}$ → area

9) $B = axzi + byzj + ck$

$\nabla \cdot B = 0$ ← differential form of gauss'

$(i\frac{d}{dx} + j\frac{d}{dy} + k\frac{d}{dz}) \cdot (axzi + byzj + ck) = 0$

$az + bz = 0$

$z(a+b) = 0$

$a + b = 0 \qquad a = -b \qquad$ C

$a = -b$

11) $L = 20\,mH = 20 \times 10^{-3}\,H \quad I = 0.2A$

$E = \frac{1}{2}LI^2 = \frac{1}{2} \times 20 \times 10^{-3} \times 0.2^2$

$E = 10 \times 10^{-3} \times 0.04 = 0.4 \times 10^{-3} = \underline{\underline{4 \times 10^{-4}}}\,J$

C

Olajide British

12) $q = -10^{6} c$ $r = 50cm = 0.5m$ $f = ?$

13) $\phi = 6t^2 + 7$ mWb $t = 2$ seconds

$\phi = (6t^2+7) \times 10^{-3}$ wb

from faraday's law; induced emf $E = -\frac{\Delta\phi}{\Delta t}$

by differentiation $\frac{\Delta\phi}{\Delta t} = (12t) \times 10^{-3}$ $t = 2$ seconds

$E = \frac{\Delta\phi}{\Delta t} = 12(t) = 24 \times 10^{-3} = 0.024v$ A

14) L N A $N = 1000$

assume N and A = 1. If doubled

$L = N$

15) Quantity of Charge B

16) B (according to flemings left hand rule.)

17) according to Gauss's law; net electric flux thru closed surface depends on net charge.

18) $q_1 = 12.0nC = 12 \times 10^{-9}c$ $q_2 = -18.0nC = -18.0 \times 10^{-9}$

$r = 0.3m$ $K = 9 \times 10^9 Nm^2/c^2$

$f = \frac{Kq_1q_2}{r^2} = \frac{9 \times 10^9 \times 12 \times 10^{-9} \times 18 \times 10^{-9}}{0.3^2}$

$\frac{(9 \times 12 \times 18) \times 10^{-9}}{0.09} = \frac{1944}{0.09} \times 10^{-9} = 21,600 \times 10^{-9}$

$= 2.16 \times 10^{-5} N$

19) $\sigma = 0.10 \mu C/m^2$ $p.d = 50V$

for infinite non conducting sheet that has surface charge σ,

$P.d = \frac{\sigma r}{2\varepsilon_0}$ $\therefore \frac{P.d \times 2\varepsilon_0}{\sigma} = r$

where r = distance

$\varepsilon_0 = 8.85 \times 10^{-12} f/m$

$r = \frac{50 \times 2 \times 8.85 \times 10^{-12}}{0.10 \times 10^{-6}} = \frac{100 \times 8.85 \times 10^{-12}}{0.1 \times 10^{-6}}$

$r = \frac{885 \times 10^{-12}}{0.1 \times 10^{-6}} = \frac{885}{0.1} \times 10^{-12--6}$

$r = 8850 \times 10^{-12+6} = 8850 \times 10^{-6}$

$r = 8.85 \times 10^{-3} m$ = to mm $= \frac{8.85 \times 10^{-3}}{10^{-3}}$

$r = 8.85mm$

20) $n = 100$ turns $R = 6\Omega$ $A = 80cm^2$

$I = 1mA = 1 \times 10^{-3}$

from the formular for induced emf

$E_{induced} = \frac{N d\phi}{dt}$ and $\phi = BA$

$E_{induced} = \frac{N d(BA)}{dt}$

$E_{induced} = \frac{NBA}{t}$

recalled that emf is = P.d, when no current flows

~~and P.d ...~~

and $P.d = I \times R$

$\therefore IR = \frac{NBA}{t}$

$\therefore R = \frac{NBA}{t}$

$I = 1\times10^{-3}A$ $R = 6\Omega$ $N = 100$ $A = 80cm^2$

$A = \frac{80}{10^4}m$

$\frac{IR}{NA} = \frac{B}{t}$; $\frac{1\times10^{-3}\times6}{100\times80\times10^{-4}} = \frac{6\times10^{-3}}{8000\times10^{-4}}$

$\frac{B}{t} = 0.00075\times10^{-3--4} = 0.00075\times10^{-3+4}$

$\frac{B}{t} = 0.00075\times10^{1} = \underline{\underline{0.0075}}\ T/s$ A

21) $C = 3.0\mu f$ $p.d = 2000v$ $E = ?$

$E = \frac{1}{2}CV^2 = \frac{1}{2}\times3\times10^{-6}\times2000^2$

$E = \frac{1}{2}\times3\times10^{-6}\times2000\times2000$

$E = \frac{1}{2}\times3\times10^{-6}\times4,000,000$

$E = \frac{1}{2}\times3\times10^{-6}\times4\times10^{6}$

$E = 1\times3\times10^{-6}\times2\times10^{6}$

$E = 3\times2\times10^{-6+6} = 6\times10^{0} = 6\times1 = \underline{6J}$ B

22) $q_1 = +2\mu C$ $q_2 = +6\mu C$

$F_{AB} = -f_{BA}$ B

reason being that, from Newton's third law, in relation to Coulomb's law between two charges, the forces exerted by two charges on each other are always equal and opposite

23) All of the above D

~~[illegible]~~

formular for mutual inductance between two coils is

$M = \frac{\mu_0\mu_r N_1 N_2 A}{L}$

where μ_r = relative permeability of iron core

N = number of turns

A = cross sectional area

$\therefore$ mutual inductance depends on all of the above. D

24)

25) $N = 160$ turns $r = 1.90cm$ $I = ?$

$m = 2.3Am^2$ $r = 0.019m$

$m = NIA$

$\frac{m}{NA} = I$

$A = \pi r^2$

$A = \frac{22}{7}\times0.019^2$

$A = 0.001134m^2$

$A \approx 0.00113m^2$

$I = \frac{2.3}{160\times0.00113} = \frac{2.3}{0.18}$

~~$I = \frac{2.3}{0.18} = 12.77$~~

$I = \frac{2.3}{0.18} = 12.777 \simeq \underline{12.78A}$ C

26) A and B

Correct formular is $\sigma = \frac{J}{E}$

where J = Current density

E = electric field

σ = Current density

olajide British

27) C

Work done in moving a Charge over an equipotential Surface is Zero.

28)

29) $N = 250$ turns $l = 20.0\,cm$ $A = 400 \times 10^{-4}\,m^2$

$L = ?$ $l = 0.2\,m$

$$L = \frac{N^2 \mu A}{l} = \frac{250^2 \times 1.26 \times 10^{-6} \times 400 \times 10^{-4}}{0.2}$$

$$L = \frac{62{,}500 \times 1.26 \times 10^{-6} \times 400 \times 10^{-4}}{0.2}$$

$$L = \frac{(62{,}500 \times 1.26 \times 400) \times 10^{-6-4}}{0.2}$$

$$L = \frac{31{,}500{,}000 \times 10^{-10}}{0.2} = 157{,}500{,}000 \times 10^{-10}$$

$L = 0.0157\,H$

30) D $f = qv \times B$

31) $W = qV$ q = an electron $= -1.602 \times 10^{-19}\,C$

$V = 12V$

$W = -1.602 \times 10^{-19} \times 12 = -19.224 \times 10^{-19}$

$W = -19.224 \times 10^{-19}\,J$

$W = -1.9224 \times 10^{-18}\,J \simeq -1.9 \times 10^{-18}\,J$ B

32) $l = 2.0\,m$ $\rho = 5.4 \times 10^{-7}\,\Omega/m$ $R = ?$

$A = 9.5 \times 10^{-3}\,cm^2 = \frac{9.5 \times 10^{-3}}{10^4} = 9.5 \times 10^{-3-4}$

$A = 9.5 \times 10^{-7}\,m^2$

$$\text{Conductivity}(\sigma) = \frac{1}{\text{Resistivity}(\rho)}$$

$$\sigma = \frac{1}{5.4 \times 10^{-7}}$$ $\sigma = 1{,}851{,}851.851$

$\sigma = 1.85 \times 10^6\,\Omega^{-1}m^{-1}$

$$R = \frac{\rho L}{A} = \frac{5.4 \times 10^{-7} \times 2}{9.5 \times 10^{-7}}$$

$$R = \frac{10.8 \times 10^{-7}}{9.5 \times 10^{-7}} = 1.1368 \times 10^{-7--7} = 1.1368 \times 10^{-7+7}$$

$R = 1.1368 \times 10^0 = 1.1368 \times 1 = 1.1368\,\Omega$

$R \simeq 1.14\,\Omega$ A

33) C   Lorentz force Law

34) $N = 10$ $A = 5\,cm^2 = \frac{5}{10^4} = 5 \times 10^{-4}\,m$

$B = 2 \times 10^{-2}\,T$ $t = 10s$ $emf = ?$

$$e = -N\frac{d\phi}{dt}$$

$\phi = BA$
$= 2 \times 10^{-2} \times 5 \times 10^{-4}$
$= 10 \times 10^{-6}$

$$e = \frac{10 \times 10 \times 10^{-6}}{10}$$

$e = 10 \times 10^{-6} = 1 \times 10^{-5}\,V$ A

Olaside British

35) $d = 12cm = 0.12m$ $\quad f = 3.9 \times 10^{-2} N$

$E = ?$ $\quad P.d = ?$ $\quad q =$ electron

$q = -1.602 \times 10^{-19} C$

$f = qE$

$E = \frac{f}{q} = \frac{3.9 \times 10^{-2}}{1.602 \times 10^{-19}} = 2.4 \times 10^{-17}$ N/C or V/m

$P.d = ?$

$E = \frac{V}{d}$ $\quad V = Ed$

$E = 2.4 \times 10^{-17}$ V/m

$d = 0.12m$

$V = 2.4 \times 0.12 \times 10^{-17} = 0.288 \times 10^{-17}$

$V = 2.88 \times 10^{-17} \simeq 2.9 \times 10^{-17} V$

$2.4 \times 10^{-17} Vm^{-1}$ and $2.9 \times 10^{-17} V$ $\quad$ A

36) $E = 160 N/c$ at $r = 15cm = 0.15m$

$E = \frac{kQ}{r^2}$ $\quad Q = \frac{Er^2}{k} = \frac{160 \times 0.15^2}{8.99 \times 10^9}$

$Q = \frac{160 \times 0.0225}{8.99 \times 10^9} = \frac{3.6}{8.99 \times 10^9} = 0.4 \times 10^{-9} C$

$E = ?$ at $r = 26cm = 0.26m$ $\quad q = 0.4 \times 10^{-9} C$

$E = \frac{kQ}{r^2} = \frac{8.99 \times 10^9 \times 0.4 \times 10^{-9}}{0.26^2}$

$E = \frac{3.596 \times 10^{9-9}}{0.0676} = \frac{3.596 \times 10^0}{0.0676} =$

$E = \frac{3.596}{0.0676} = \frac{3.6}{0.0676} = 53.25 \simeq 53.3$

$E = 53.3 N/C$ $\quad$ A

37) inductor stores energy in a magnetic field. B

38) resistance of a wire R

$R \propto \rho \propto L \propto \frac{1}{A}$

Correct answer is B

39) $E = 30,000 N/C$ $\quad f = ?$

$q =$ electron $= 1.602 \times 10^{-19} C$

$E = \frac{f}{q}$ $\quad f = qE$

$f = 1.602 \times 10^{-19} \times 30,000$

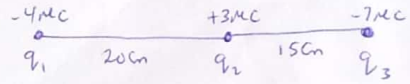
$f = 48,060 \times 10^{-19} = 4.8 \times 10^{-15} N$

C

40) A

for sound waves to travel, it requires a material medium

42)



$f = \frac{kQ_1Q_2}{r^2}$ $\quad f = \frac{kQ_2Q_3}{r^2}$

$f = 2.7 N$ $\quad f = 8.4 N$

Net force on $q_2 = 2.7 + 8.4 N$

$= 11.1 N/C$ D

Olajide British

Scanned with CamScanner

42)

43) $V_p = 120V$ $n_p = 200$ turns $n_s = 50$ turns

$R(\text{load}) = 100\Omega$ light bulb

Calculate V_s first

$$\frac{V_p}{V_s} = \frac{n_p}{n_s} ; \quad \frac{120}{V_s} = \frac{200}{50}$$

$$V_s = \frac{\cancel{120}^{6} \times 5\cancel{0}}{\cancel{200}} = 6 \times 5 = 30v$$

now $V = IR$

$V = V_s = 30v$ $I = ?$ $R = 100\Omega$

$$I_s = \frac{V}{R} = \frac{30}{100} = 0.3A$$

$$\frac{V_p}{V_s} = \frac{n_p}{n_s} = \frac{I_s}{I_p}$$

$$\frac{n_p}{n_s} = \frac{I_s}{I_p} ; \quad \frac{200}{50} = \frac{0.3}{I_p}$$

$$I_p = \frac{50 \times 0.3}{200} = 0.075A$$ B

$I_p = 0.075A$ ← Current drawn from power line.

44) Reverses direction (due to -ve sign) B

45) $l_1 = 20m$ $L_1 = 6mH$ $L_2 = 2 \times L_1$

$L_2 = ?$

$$L = \frac{N^2 \mu A}{l}$$

~~[illegible]~~

~~[illegible]~~

~~[illegible]~~

46) $$\phi_{total} = \frac{q}{\varepsilon_0}$$

$q = +3-2-2+4-1\,nC = 7-5\,nC = 2nC$

$\varepsilon_0 = 8.9 \times 10^{-12}$

$$\phi_{total} = \frac{2 \times 10^{-9}}{8.9 \times 10^{-12}} = 0.224 \times 10^{-9--12}$$

$\phi_{total} = 0.224 \times 10^{3} = 224 \simeq 200Vm$

A

47) $d = 6.5cm = 0.065m$ $N = 12$ turns

$I = 2.7A$ $B = 0.56T$

$\tau = NIAB\sin\theta$

maximum torque occurs at $\theta = 90°$

$\sin 90° = 1$ $A = \pi r^2$

$d = 0.065$

$r = \frac{0.065}{2} = 0.0325$

$A = \pi \times 0.0325^2$

$A = 0.0033196$

$\tau = 12 \times 2.7 \times 0.0033196 \times 0.56$

$= 0.06023Nm$

Majide Brit3h

48) $I = \int j \cdot dA$ C

49) $U_E = \frac{K q_1 q_2}{r}$ U_E = electric potential energy

$q_1 q_2$ = electrons $= 1.602 \times 10^{-19}$

$r = 20nm$ $= 20 \times 10^{-9}$

$$U_E = \frac{8.99 \times 10^{9} \times 1.602 \times 10^{-19} \times 1.602 \times 10^{-19}}{20 \times 10^{-9}}$$

$$U_E = \frac{(8.99 \times 1.602 \times 1.602)}{20} \times 10^{9-19-19+9}$$

$$U_E = \frac{23.07}{20} \times 10^{-20} = 1.1535 \times 10^{-20}$$

$U_E = 1.15 \times 10^{-20}$ J Similar to A

50) electric potential due to point charge

$V = KQ/r$ $r = 5.29 \times 10^{-11} m$

$K = 8.99 \times 10^{9} Nm^2/C^2$

$Q = 1.602 \times 10^{-19} C$

$V = 8.99 \times 10^{9} \times 1.602 \times 10^{-19} \div 5.29 \times 10^{-11}$

$V = (8.99 \times 1.602 \div 5.29) \times 10^{9-19+11}$

$V = 14.40 \div 5.29 \times 10^{1}$

$V = 2.72 \times 10^{1}$

$V = \underline{27.2}$ C

Olasile British