UACE PHYSICS PAPER 2010 GUIDE

Instructions to the candidates:

Answer **five** questions taking at least one from each of the sections **A, B, C** and **D**, but not more than one question should be chosen from either section **A** or **B**

Any additional question (s) will not be marked.

Mathematical tables and squared paper will be provided

Non programmable calculators may be used.

Assume where necessary

Acceleration due to gravity, g	$9.81ms^{-2}$
Electron charge, e	$1.6 \times 10^{-19}C$
Electron mass	$9.11 \times 10^{-31}kg$
Plank's constant, h	$6.6 \times 10^{-34}Js$
Speed of light in the vacuum, c	$3.0 \times 108ms^{-1}$
Specific heat capacity of water	$4.200Jkg^{-1}K^{-1}$
Avogadro's number, N_A	$6.02 \times 10^{23}mol^{-1}$
The constant, $\frac{1}{4\pi\varepsilon_0}$	$9.0 \times 10^{9}F^{-1}m$
Permittivity of free space, μ_0	$4.0\pi \times 10^{-7}Hm^{-1}$
Permittivity of free space, ε_0	$8.85 \times 10^{-12}Fm^{-1}$
One electron volt	$1.6 \times 10^{-19}J$
Resistivity of Nichrome wire at 25^0C	$1.2 \times 10^{-6}\Omega m$

SECTION A

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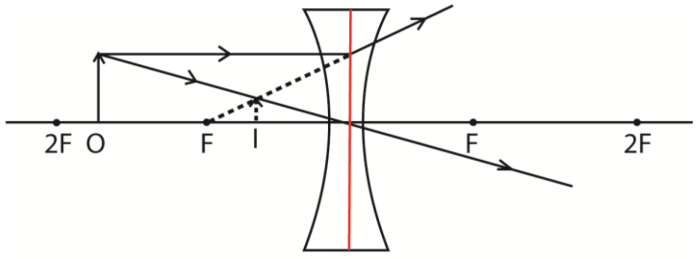
1. (a) (i) Define principal focus of a concave lens. (01marks)

Principal focus of a concave lens is the point on the principal axis where rays of light parallel and close to principal axis appear to diverge from after refraction through the lens.

(ii) Draw a ray diagram to show formation of an image of finite object in a concave lens (02marks)



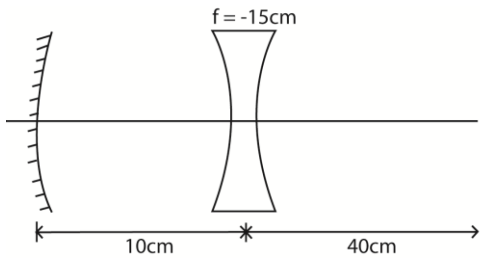
O = object I = image

(iii) Describe the image formed in (a)(ii) (01mark)

- it is virtual and diminished.

(b) A concave mirror of radius of curvature 20cm is arranged coaxially with a concave lens of focal length 15cm, placed 10cm from the mirror. An object, 3cm tall is placed in front the concave lens and its image is formed on a screen 40cm away from the lens.

(i) Find the position of the object. (07marks)



Action of the concave lens, f = -15, u = 40cm

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{15} - \frac{1}{40} = \frac{-120}{11}$; v = -10.91cm

Action of concave mirror

u = 10 + 10.91 = 20.91cm, f = 10

$\frac{1}{10} = \frac{1}{20.91} + \frac{1}{v}$; v= 19.17

Action of the lens

u=9.17cm, f=-15cm

$\frac{1}{v} = \frac{1}{-15} + \frac{1}{9.17}$; v = 23.55cm in front of the lens

(ii) What is the height of the image formed? (03marks)

$$M = M_1 \times M_2 \times M_3 = \frac{v_1}{u_1} x \frac{v_2}{u_2} x \frac{v_3}{u_3} = \frac{10.91}{40} x \frac{19.17}{20.91} x \frac{23.55}{9.17} = 0.64$$

Image height = 0.64 x 3 = 1.9

(iii) Explain what would happen if the lens was replaced with a similar one but of much smaller focal length. (03marks)

If the lens was replaced with one of a smaller focal length, the final image would have been smaller. This is because the power of a lens = $\frac{1}{f}$; therefore a lens of smaller focal length has a larger magnifying power.

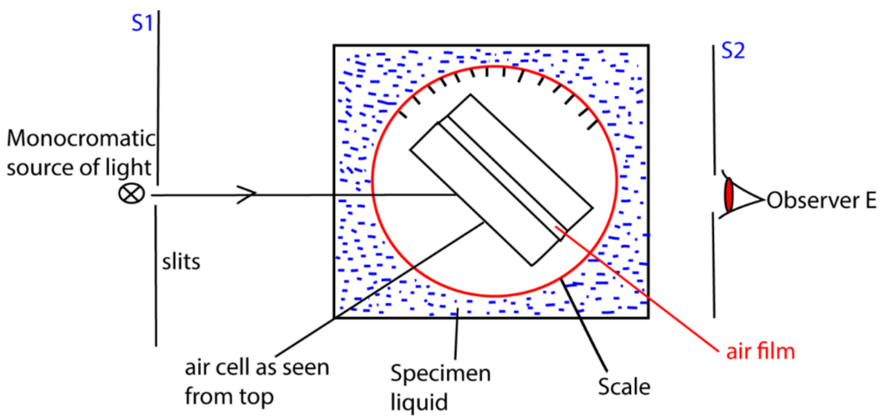
(c) Explain how spherical aberration is minimized in a photographic camera.(03marks)

- Spherical aberration in a photographic camera is minimized by the diaphragm. The diaphragm only allows central beam which forms a sharp image.
- using composite lens

2. (a) Define refractive index. (01mark)

Refractive index of a medium is the ratio of the speed of light in vacuum to the speed of lght in a medium.

(b) (i) Describe with the aid of a diagram, how the refractive index of a liquid can be determined using air cell. (05marks)



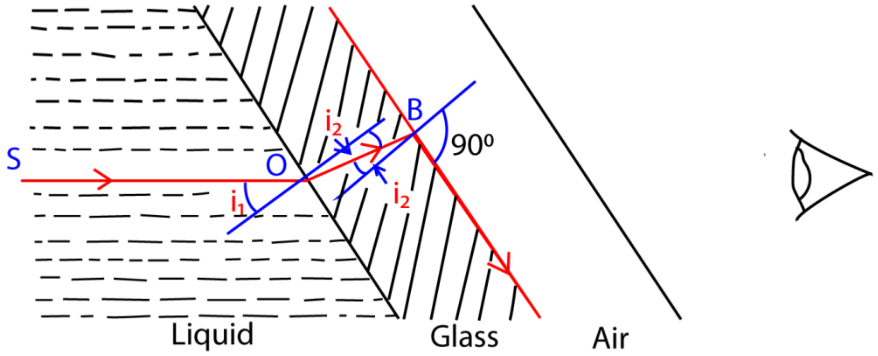
- The air cell is immersed in a liquid under test.
- A beam of monochromatic light is directed onto the air cell and then observed through the cell from the opposite side at **E**.
- The cell is then rotated on one side until light is suddenly cut off and the angular position **θ1** is noted.
- The cell is again rotated in the opposite direction until light is suddenly cut off and the angular position **θ2** is noted.

- The refractive index of the liquid can then be calculated from

$$\mathbf{n} = \frac{1}{\sin\theta} \quad \text{where } \boldsymbol{\theta} = \frac{\theta 1 + \theta 2}{2}$$

(ii) Derive the expression used to obtain the refractive index of the liquid in (b)(i) (03marks)

Setup



Ray **SO** is refracted along **OB** in glass. However, at **B** total internal just begins. Suppose $\mathbf{i_1}$ is the angle of incidence in the liquid, $\mathbf{i_2}$ is the angle of incidence in the glass while **n** and **ng** are the corresponding refractive indices, Then applying the relation **n sin i = a constant** gives

$n \sin i_l = n_g \sin i_2 = n_a \sin 90^0$

$\therefore\ n \sin i_l = n_a \sin 90^0$

but $n_a \sin 90 = 1$

Thus n $= \frac{1}{\sin i_1}$

Since, Angle i $= \frac{\theta_1 + \theta_2}{2}$

n $= \frac{1}{\sin \theta}$

(c) A prism of refractive angle 60^0 has refractive indices 1.515 and 1.529 for red and violet respectively. When white light is incident on one face of the prism, red light undergoes minimum deviation. Calculate the angle of

(i) incidence for white light (04marks)

At minimum deviation

$$n_r = \frac{\sin\left(\frac{D+A}{2}\right)}{\sin\frac{A}{2}} = \frac{\sin i}{\sin\frac{A}{2}}$$

$$\sin i = 1.51 sin\frac{60}{2}$$

i = 49.03

(ii) emergence for violet light. (03marks)

At the first face, sini = nsinr

Sin r $= \frac{\sin 49.03}{1.529}$

r = 29.6^0

$r_1 + r_2 = 60$

$r_2 = 60 - 29.6 = 30.4$

At the second face

$1.529\sin 30.4 = \sin i$

$i = 50.7^0$

(d) Describe the adjustment that have to be made before a spectrometer can be used. (04 marks)

- The collimator is adjusted to produce parallel rays of light.
- The turn table is leveled.
- The telescope is adjusted to receive light from the collimator on its cross wire.

3. (a) (i) Define amplitude of a wave. (01mark)

It is the maximum displacement of a particle in a transmitting medium from its equilibrium position

(ii) State two characteristics of a stationary wave (02 mark)

- Amplitude of a wave varies from place to place along the profile.
- Wave energy is not transmitted along the profile.
- At certain points called nodes, the particles are permanently at rest
- Has nodes and antinodes.

(iii) A progressive wave y = asin(ax-kx) is reflected at a barrier to interfere with the incoming wave. Show that the resultant is a stationary wave (04marks)

Incident wave $y_1 = a\sin(\omega t - kx)$

Reflected wave $y_2 = a\sin(\omega t + kx)$

Resultant wave $= y_1 + y_2$

$= a\sin(\omega t - kx) + a\sin(\omega t + kx)$

$= 2a\sin\frac{2\omega t}{2}\cos\left(\frac{-2kx}{2}\right)$

$= 2a\sin\omega t\cos kx$

$= (2a\cos kx)\sin\omega t$

$= A\sin\omega t$

Where A is the amplitude of a wave

Now $A = 2a\cos kx$ varies with distance x.

Therefore the wave is a stationary one.

(b) (i) What is meant by beats? (02marks)

A beat is the periodic rise and drop in intensity of sound heard when two notes of nearly equal frequency are sounded together.

(ii) Describe how you can determine the frequency of a musical note using beats. (05marks)

The musical not is sounded together with a tuning fork of known frequency, f_1. The number of beats, n, in time, t, are counted.

Beat frequency, $f_b = \frac{n}{t}$

One prong of the tuning fork is loaded with plasticine and then the experiment is repeated.

New beat frequency, $f'_b = \frac{n}{t}$ is determined.

If $f_b > f'_b$, then the frequency of the test note, $f_n = f_T - f_b$.
If fb < f'b, then the frequency of test node, $f_n = f_b + f_T$.

(c) Two open pipes of length 92cm and 93cm are found to give beat frequency of 3.0Hz when each is sounding in its fundamental note. If the end errors are 1.5cm and 1.8cm respectively, calculate the

(i) velocity of sound in air (04marks)

From beat frequency, $f_0 = \frac{v}{2(L_1+2c_1)}$

$$f_b = f_{92} - f_{93}$$

$$= \frac{v}{2(L_1+2c_1)} - \frac{v}{2(L_2+2c_2)}$$

$$3 = \frac{v}{2}\left(\frac{1}{(0.92+2\ x\ 0.015)} - \frac{1}{(0.93+2x\ 0.018)}\right)$$

$$v = 344.14ms^{-1}$$

(ii) frequency of each note (02mark)

$$f_0 = \frac{v}{2(L_1+2c_1)}$$

$$f_{92} = \frac{344.14}{2(0.92+2\ x\ 0.015)} = \frac{344.14}{2\ x\ 0.95} = 181.13Hz$$

$$f_{932} = \frac{344.14}{2(0.93+2\ x\ 0.018)} = \frac{344.14}{2\ x\ 0.966} = 178.13Hz$$

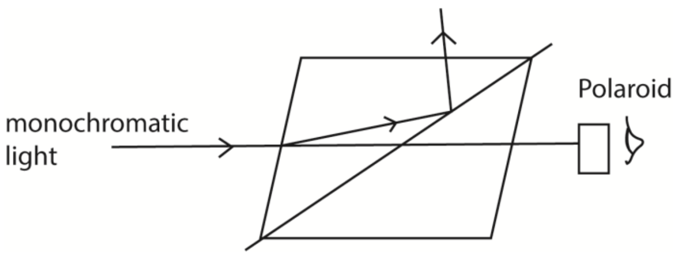
4. (a) (i) Define the term diffraction. (01mark)

Diffraction is the spreading of a wave beyond its geometrical shadow (boundaries) leading to interference.

(ii) What is meant by plane polarized light? (01mark)

Plane polarized light is one in which the variation of its electric vector takes place in one plane only.

(b) (i) Describe how polarized light is produced by double refraction. (05 marks)

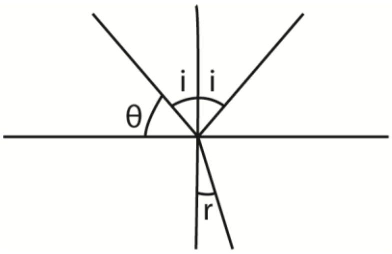


- A narrow beam of ordinary light is made incident on nicol prism and viewed through analyzer as shown above
- The angle of incidence is gradually increased or change and at each angle, the polaroid is rotated about an axis through its plane.
- At certain angle of incidence, light is completely extinguished
- At this point, the emergent light is plane polarized.

(ii) State two uses of polarized light (02mark)

Used in sunglasses to reduce glare
Used in photo-elasticity to identify regions of stress in a material
Used to determine the concentration of sugars

(iii) A parallel beam of unpolarized light incident on transparent medium of refractive index 1.62, is reflected as polarized light. Calculate the angle of incident in air and angle of refraction in the medium (03marks)



By Brewster's law, if reflected ray is polarized, tan θ = n = 1.62

θ = 58.3^0

Angle of incidence, i = 90 – 58.3^0 = 31.7^0.

From n = $\frac{\sin i}{\sin r}$

1.62 =$\frac{\sin 31.7}{\sin r}$; r = 19^0

(c) (i) What is diffraction grating? (01mark)

A diffraction grating is a transparent plate with many small parallel lines drawn on it using a diamond pencil

(ii) Sodium light of wavelength 5.890 x 10^{-7}m and 5.896 x 10^{-7}m fall normally on a diffraction grating. If the first order beam, the two sodium lines are separated by 2minutes, find the spacing of grating (03marks)

For first order diffraction, dsinθ =λ

$\sin\theta_1 = \frac{\lambda_1}{d}$ ……………………………….. (i)

$\sin\theta_2 = \frac{\lambda_2}{d}$ ……………………………….. (ii)

but $\sin\theta_2 = \left(\theta_1 + \frac{2}{60}\, x\, \frac{\pi}{180}\right)$

Eqn. (ii) – Eqn. (i)

$\text{Sin}\left(\theta_1 + \frac{\pi}{60\, x\, 180}\right) - \sin\theta_1 = \frac{\lambda_2 - \lambda_1}{d}$

$= 2\cos\left(\theta_1 + \frac{\pi}{60\, x\, 180}\right)\sin\left(\frac{\pi}{60\, x\, 180}\right) = \frac{\lambda_2 - \lambda_1}{d}$

$= \left(\frac{5.896 - 5.890}{d}\right) x\ 10^{-7}$

(d) State three differences between the spectra produced by a prism and that by diffraction grating. (03marks).

Prism	Diffraction grating
- Produce single spectrum at a time	- Many spectra at a time
- Shorter wavelengths are deviated most	- Longer wavelength are deviated most.
- Produce less pure spectrum	- Produce more pure spectrum

SECTION B

5. (a) Define the term **magnetic flux density**. (01mark)

Magnetic flux density is the force acting on a charge of 1C moving with a velocity of $1ms^{-1}$ at right angle to magnetic field.

(b) Write expression for the

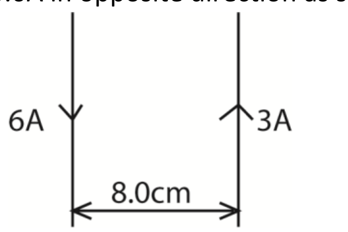
(i) magnetic flux density at a perpendicular distance, R, from a long straight wire carrying current, I, in air. (01mark)

B = $\frac{\mu_0 I}{2\pi R}$

(ii) Force on a straight conductor of length, L (meters) carrying current, I (ampere) at an angle, θ, to a uniform magnetic field of flux density, B (tesla)

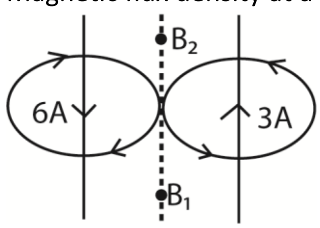
F = BILsinθ

(c) Two straight long and straight wires of negligible cross-section area carry currents of 6,0A and 3.0A in opposite direction as shown below



If the wire are separated by a distance of 8.0cm, find the;

(i) Magnetic flux density at a point mid-way between the wires (04marks)



Magnetic flux density midway between the wires.

B = $B_1 + B_2$

= $\frac{\mu_0 I_1}{2\pi R} + \frac{\mu_0 I_2}{2\pi R}$

= $\frac{6\,x\,4\pi\,x\,11110^{-7}}{2\pi\,x\,0.4} + \frac{6\,x\,4\pi\,x\,11110^{-7}}{2\pi\,x\,0.4}$

= 4.5×10^{-5}T

(ii) Force per meter between the wire (03marks)

$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi a} = \frac{4\pi\ x\ 10^{-7}\ x6\ x\ 3}{2\pi n\ x\ 0.8}$ = 4.5 x $10^{-5}Nm^{-1}$

(d) Define:

(i) angle of dip (01mark)

Angle of dip is the angle between the earth's resultant magnetic flux density and the horizontal.

(ii) angle of declination (01mark)

Angle of declination is the angle between the earth's magnetic and geographical axes or angle between the earth's meridian and geographical meridian.

(e) A straight conductor of length, L, is perpendicular to magnetic field of flux density B. If the conductor moves with velocity, U, at an angle θ to magnetic field, derive the expression for e.m.f induced. (04marks)

Component of the velocity perpendicular to B is Usinθ

Area swept by conductor in one second is Lsinθ

Change in magnetic flux linkage in 1s = BLsin θ

But induced e.m.f = $-\frac{d\theta}{dt}$

$$\therefore |E| = BLsin\ \theta$$

(f) An aircraft of wing 20m is moving horizontally from west to east at a velocity of 250ms^{-1} in a place where the angle of dip is 40^0. The e.m.f induced across the tips of the wings is 6mV. Find the magnetic flux density of the earth field. (04mrks)

Component of B_E perpendicular to U = $B_E$sinθ

∴ Induced e.m.f of E = $B_E$sin θ x LU

$B_E = \frac{E}{LUsin\ \theta} = \frac{6\ x\ 10^{-3}}{20\ x\ 250\ x\ \sin 40}$ = 1.867 x 10^{-6}T

6. (a) State the laws of electromagnetic induction. (02marks)

The magnitude of the induced e.m.f is directly proportional to the rate of change of magnetic flux linking the circuit or conductor.

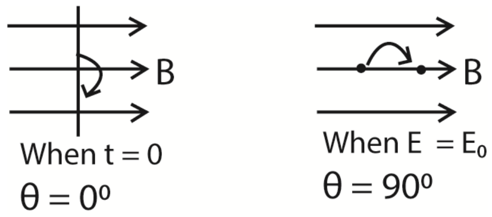
The direction of the induced e.m.f is such that it tends to oppose the charge causing it.

(b) The e.m.f generated in a coil rotating in a uniform magnetic field is given by E_0sinωt.

(i) State the meaning of the symbols used and give their units. (03marks)

- E_0 is the maximum(peak) value of e.m.f in volts
- ω is the steady angular velocity of the coil in radians per second.
- t is time in seconds.

(ii) Draw diagrams showing the relative positions of the coil and the magnetic field when t is zero and when the e.m.f generated is E_0. (03marks)



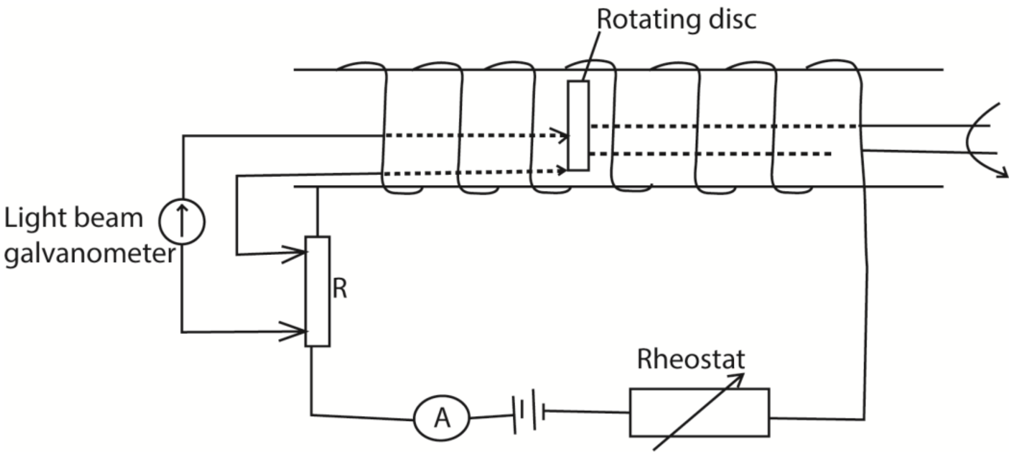
(c) A rectangular coil of 50turnsis 15.0cm wide and 30.0cm long. If it rotates at a uniform rate of 2000 revolution per minute about an axis parallel to its long side and at right angles to a uniform magnetic field of flux density 0.04T, find the peak value of the e.m.f induced in the coil (03marks)

Induced e.m.f, E = $\omega NAB \sin\omega t$

Where $E_0 = \omega NAB$

$= \frac{2000}{60}\ x\ 2\pi\ x 50\ x\ 0.15\ x\ 0.1\ x\ 0.30\ x\ 0.04$ = 18.84V

(d)A solenoid of, n, turns per meter, a resistor, R, an ammeter, A, and a rheostat are connected to the battery as shown in the figure below. A disc of radius, r, is mounted inside the solenoid with is axis coincident with that of the solenoid. The center and rim of the disc are connected across, R. The disc is rotated with its plane perpendicular to the axis of the solenoid at a frequency, f.



The rheostat is adjusted until the galvanometer shows no deflection and ammeter reads a current of I amperes.

(i) Show that the e.m.f induced between the center and rim of the disc is πBr^2f, where B is magnetic flux density inside the solenoid. (04marks)

Magnetic flux density with the disc, ϕ = BA

Now induced e.m.f E = $\frac{-d\phi}{dt} = \frac{dBA}{dt} = B\frac{dA}{dt}$

But $\frac{dA}{dt} = \frac{\pi r^2}{T} = \pi r^2 f$ since 1/T = f

$\therefore |E|$ = B $\pi r^2 f$

(ii) Deduce an expression for resistance of R, in terms of n, f, I and r.

IR = B $\pi r^2 f$ but B = $\mu_0 nI$
IR = $\mu_0 nI\pi r^2 f$
R = $\mu_0 n\, \pi r^2 f$

(iii) State two limitations of the above set up in measurement of resistance.

Since the e.m.f generated is very small the method is only used to measure very small resistance.

- The earth's magnetic field affects the induced e.m.f.
- The effect of thermal e.m.f generated due to friction at the contact.

7. (a) (i) Distinguish between root mean square value and peak value of an alternating current. (02marks)

Root mean square value of alternating current is the value of steady or direct current which dissipates heat in a given resistor at the same rate as the alternating current, while **peak value** is the maximum value of current.

(ii) What is peak value of voltage from a 240 a.c mains? (02marks)

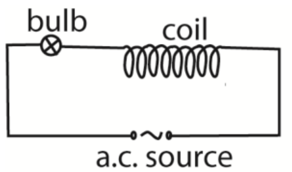
$V_{r.m.s}$ = 240

But $V_0 = \sqrt{2V_{r.m.s}}$

$= \sqrt{2 \ x \ 240}$

= 339.4V

(b)



An air-cored coil, a bulb and an a.c. source are connected as shown in figure above. When a solid iron core is introduced in the coil, the bulb becomes dimmer and the core hot. Explain the observation. (06marks)

When the iron core is introduced into the coil, the magnetic flux linkage with the coil increases. The rate of change of magnetic flux linkage with the coil increases, and hence an increase in the induced back e.m.f. This leads to a reduction in the current flowing through the bulb that dims.

The changing magnetic flux in the coil induces Eddy currents in the iron core. These currents cause the core to heat up by I^2R mechanism

Secondary, the changing magnetic field continuous reverse magnetization of the core thus reversing the magnetic domains of the core. This leads to heating of the core due to friction between domains or hysteresis.

(c) (i) What is meant by the term inductive reactance? (01mark)

Inductive reactance is non-resistive opposition to flow of alternating current through the inductor.

(ii) Derive an expression for reactance of an inductor of inductance L when a sinusoidally varying a.c. of frequency, f, passes through it. (05marks)

Suppose current $I = I_0 \sin 2\pi ft$ flows through an inductor where I_0 is amplitude.

Induced back e.m.f $E = -L\frac{dI}{dt}$

For finite current in a pure inductor applied voltage V = -E

$$= -L\frac{d(I_0 \sin 2\pi ft}{dt}$$

$$= -2\pi fLI0\cos 2\pi ft$$

$\therefore V_0 = 2\pi fLI_0$

Now reactance $X_L = \frac{V_0}{I_0} = \frac{2\pi fLI_0}{I_0} = 2\pi fL$

(iii) A sinusoidal alternating voltage of $6.0V_{r.m.s}$ and frequency 1 kHz is applied to a coil of inductance 0.5H. Assuming that the coil has negligible resistance, calculate the root mean square value of current. (03marks)

- $I_{r.m.s} = \frac{V_{r.m.s}}{X_L} = \frac{V_{r.m.s}}{2\pi fL} = \frac{6.0}{2 \ x \ 3.14 \ x \ 1000x \ 0.5}$ 1.9×10^{-3}A

(d) State one advantage of a.c over d.c.

- a.c can easily and cheaply be changed from one voltage to another.
- a.c can easily be transmitted with little power loss
- a. c. is cheap to generated

SECTION C

8. (a) (i) Define electrical resistivity and state its units (02marks)

Electrical resistivity is the resistance across opposite faces of a 1m cube of material. Unit of electrical resistivity is ohmmeter (Ωm)

(ii) What is meant by e.m.f and internal resistance of a battery (02marks)

E.m.f of a battery is the energy required to convey 1C of charge round a complete circuit including the cell

Internal resistance of a battery is the resistance in series with external circuit which accounts for energy losses inside a battery when the battery is supplying current.

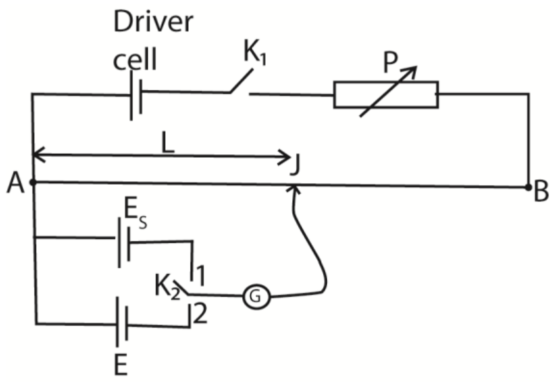
Or

The opposition to the flow of current inside the battery due to its chemical composition.

(b)Explain why resistance of a metal increases when temperature of the metal is increased. (02marks)

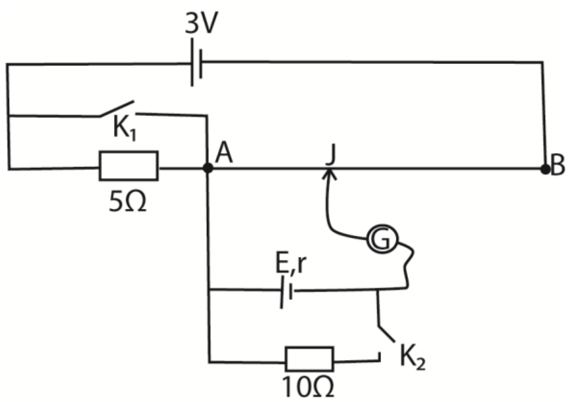
When the temperature of a metal increases, the amplitude of vibration of its atoms increases. This reduces the mean free path for conduction of electrons. Thus fewer electrons flow per second through the metal; the current flowing reduces and thus resistance increases.

(c) Describe with the aid of labelled diagram, how a slide wire potentiometer may be used to determine the e.m.f of a battery. (06marks)



- The circuit is connected as above.
- Switch K1 ia closed
- Switch K_2 is connected to 1 and contact J is moved along AB to appoint where the galvanometer shows no deflection and the balance length L_0 s measured.
- Switch K_2 is connected to 2 and contact J is moved along AB to appoint where the galvanometer shows no deflection and the balance length L s measured.
- If the e.m.f of the test cell is E, then E = $E_S \frac{L}{L_0}$
-

(d)



The circuit in the figure above shows a uniform slide wire AB of length 100cm and resistance 10Ω. The wire is connected in series with a resistor of resistance 5Ω across 3.0V battery of negligible internal resistance. A cell of resistance, E and internal resistance, r, is connected as shown. With switches K_1 and K_2 open, the galvanometer, G shows no deflection when AJ is 75.0cm. With K_1 and K_2 closed, the galvanometer shows no deflection when AJ is 65.0cm. Find the

(i) Value of e.m.f, E.

At balance with K_1, K_2 open, e.m.f.,

E = p.d across AD

-= I x R

$= 3\,x\,\frac{15}{(15+5)}\,x\,\frac{75}{100}$= 1.69V

(ii) Internal resistance, r

When K_1 is open and K_2 closed

P.d across 10Ω resistor, V = $3\,x\,\frac{15}{20}\,x\,\frac{65}{100}$ = 1.46V

But $\frac{E}{V} = \frac{R+r}{R}$

$\frac{1.69}{1.46}$ = $1 + \frac{r}{10}$

r = 1.6Ω

(iii) Balance length when K_1 is closed, and K_2 is open

K1 closed and K2 open

p.d per cm of AB = $\frac{3}{100} Vcm^{-1}$

If the balance length is L', then $\frac{3}{100}L' = 1.69$

L' = 56.3cm

9. (a) (i) Define electric potential (01mark)

Electric potential at a point is the work done in moving a positive charge of one coulomb from infinity to that point in an electric field against electrostatic force.

(ii) Derive an expression for electric potential at a point which is a distance, r, from a point charge Q (04marks)

Force on 1C of a charge, F = $\frac{Q}{4\pi\varepsilon x^2}$

Work done to move the charge through distance Δx against the field

Δw = -FΔx

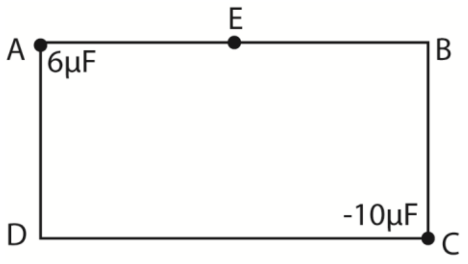
Total work done to bring the charge from infinity to a point, a distance r from a charge Q'

w = $\int_{\infty}^{r} -Fdx = \int_{\infty}^{r} = \frac{-Q}{4\pi\varepsilon x^2}dx$

$= -\frac{Q}{4\pi\varepsilon}\left[\frac{1}{x}\right]_{\infty}^{r}$

$= \frac{Q}{4\pi\varepsilon r}$

(b) Two charges of magnitude 6μF and -10μF are placed at the corners of a rectangle ABCD as shown in the figure below



AB = 6cm and BC = 4cm. Point E is the mid-point of AB. Find the work done in taking a point charge of 1.6 x 10^{-10}C from D to E. (05marks)

Electric potential, V = $\frac{Q}{4\pi\varepsilon_0 r}$

V_D = 9 x$10^9\left[\frac{6\ x\ 10^{-6}}{4\ x\ 10^{-2}} - \frac{10\ x\ 10^{-6}}{6\ x\ 10^{-2}}\right]$ = -1.5 x 10^5V

CE = ED

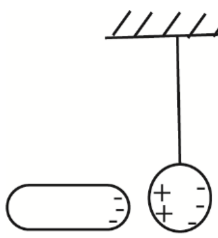
CE = $\sqrt{3^2 + 4^2}$ = 5

V_E = 9 x$10^9\left[\frac{6\ x\ 10^{-6}}{3\ x\ 10^{-2}} - \frac{10\ x\ 10^{-6}}{5\ x\ 10^{-2}}\right]$ = 0V

VED = 0 – (-1.5 x 10^5) = 1.5 x 10^5V

w = QV = 1.6 x 10^{-10} x 1.5 x 10^5= 2.4 x 10^{-5}J

(c) A negatively charged ebonite rod is brought up to an uncharged pith ball suspended by a silk thread. The pith-ball first moves to the rod, touches it and then moves away. Explain these observations (04marks)



The charged ebonite rod induces positive charge on the side of the ball near it and thus attract it.

After contact, the ball acquires a negative charge and thus the two bodies repel each other.

END