AL Physics MC Answers

Year:1984

Question Number:1,16,19,20,24,25,27,43,46

1984MC (1)

Before sliding, the fiction always balance the pulling force in order to keep the object stationary. However, friction has a maximum value ($\mu_s R$, where μ_s is called the static coefficient of friction and R is the normal reaction force from the floor). When the pulling force is greater than that value, friction will not increase any more. The object starts to move and then the friction will drop abruptly to a slightly smaller constant $\mu_k R$, where μ_k is called the kinetic coefficient of friction.

No sliding, friction = pulling force

Pulling force > $\mu_s R$, the object slides, the friction reduces slightly to $\mu_k R$.

1984MC(16)

The zeroth order shifts to the 8th order, i.e. moves a distance of 8 fringes width.

Originally, the path difference in forming the 9th order bright fringe is 8λ.

After the insertion of the mica plate, the path difference disappears.

The speed in a medium of refractive index n is c/n

Light passing through a distance d in a medium of refractive index n is equivalent to travel a distance of nd in vacuum.

Now, a distance d is replaced by nd, the **extra length** introduced is nd-d = (n-1)d.

If the extra length (n-1)d is introduced to the geometrical shorter path and just equal to 8λ., the original path difference (8λ) will become zero.

$(1.6 - 1)d = 8(600\text{ nm})$

$d = 8000\text{ nm}$

1984MC(19)

It is a simplified multimeter.

The multimeter is now used as an ammeter, so P should be connected to "1".

If "2" or "3" is used, the current passing through the latter stage is still 0.5 A, but the internal resistance of the "ammeter" will hence be increased, it is undesirable.

The meter and the shunt are in parallel, $I \propto \frac{1}{R}$.

If the 1.01 Ω is used, the current passing through the meter is

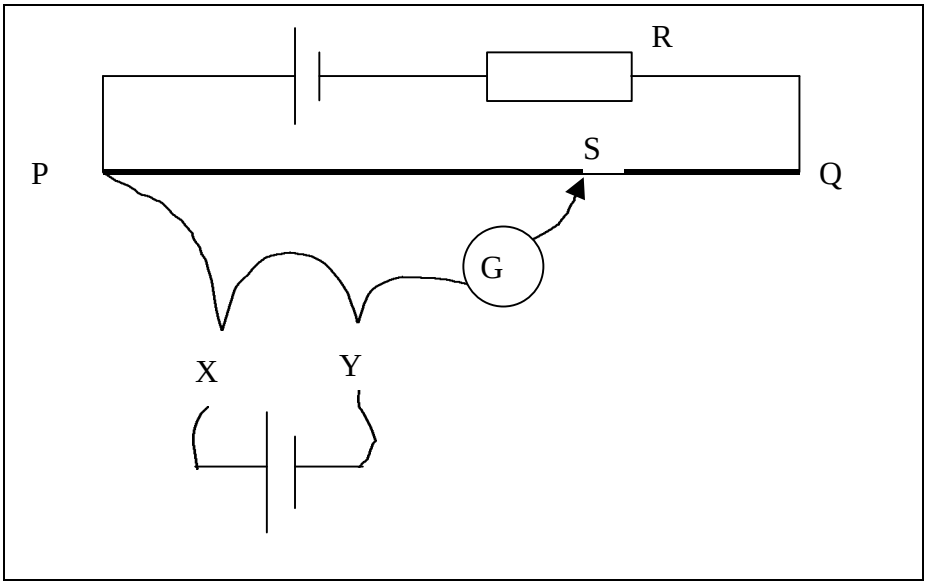
0.5[1.01/(1.01+100)]=0.005 A = 5 mA> 1 mA

If the 0.1001 W is used, the current passing through the meter is 0.2[0.1001/(0.1001+100)]=0.0005 A=0.5 mA < 1 mA

Obviously, Q should be connect to "2"

1984MC(20)

A null point (zero reading of the galvanometer) between PQ is found only when $V_{PQ} > V_{XY}$ and X is connected to the "+" terminal of the thermocouple (image the thermocouple is a cell, as shown in the figure).



If a null point is not found and

(i) the reading increases as the slider is moved from P to Q, the polarities of X and Y are wrong.

(ii) the reading decreases as the slider is moved from P to Q, the whole V_{PQ} is inadequate to balance the emf of the thermocouple.

Now, case (ii) happens,

Among the five options, " (C) the resistance R is too large" is correct. Because of that, the p.d. across the wire, $V_{PQ,}$ is too small

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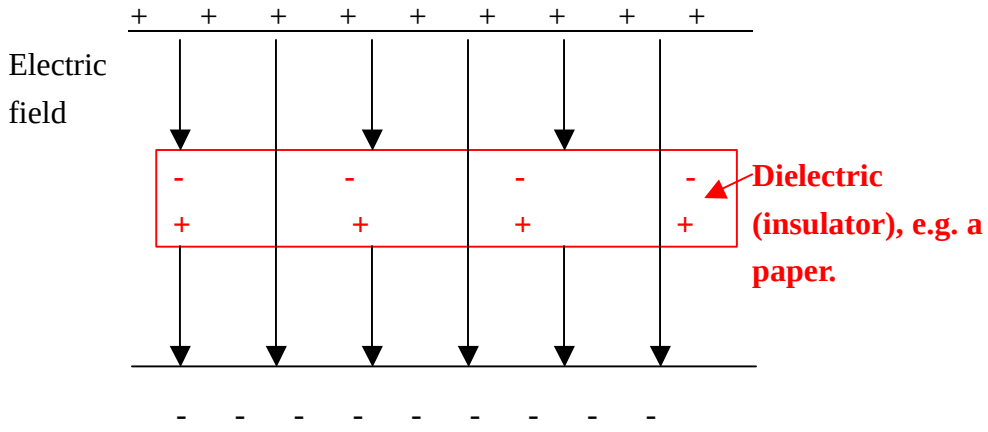
1984MC (24)



Inside a conductor, E = 0

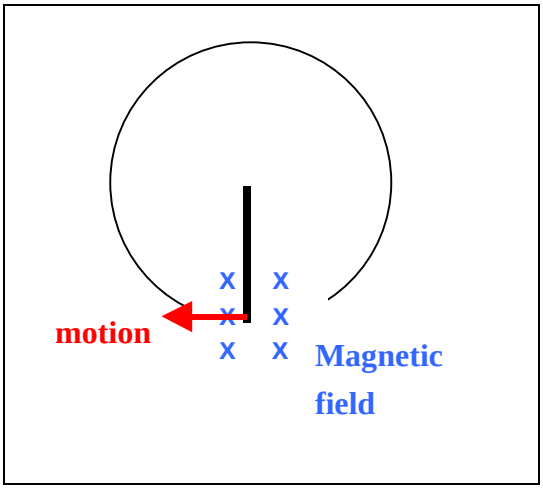
Unlike a conductor, a dielectric (insulator) does not have free electrons, so it is possible for it to have an E-field inside. Nevertheless, the induced charge on its surfaces (caused by bound charges, not free charges) will weaken the electric field inside.

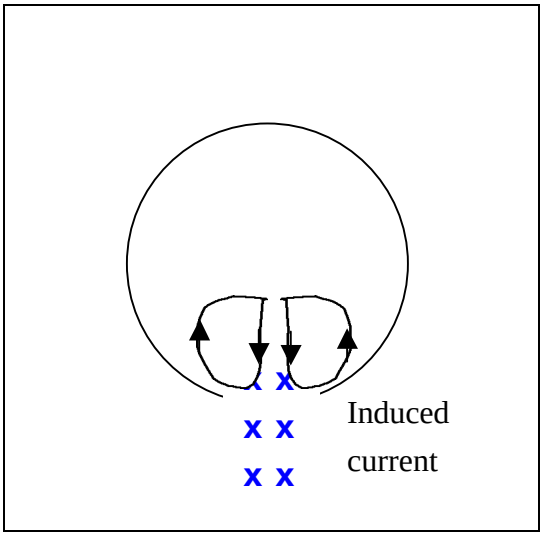
1984MC(25)

$I_C = \beta I_B$ and $I_E = (\beta+1) I_B \approx I_C$

Therefore I_C/I_E is less than 1 and $I_C/I_B = \beta >> 1$

984MC(27)





Consider a thin strip of the disc which is moving in the field (in fact, the whole disc can be regarded as a parallel conection of many of these strips). By Fleming's right hand rule, an induced current flows downwards.

The current should flow back in order to form a complete circuit. The whole disc is a complete circuit indeed. The current will take the shortest path (smallest resistance) to return. Also, the return path must lie outside the magnetic field (inside the field, the current is only downward).

These currents are called eddy currents

1984MC (43)

Actual specific latent heat of fusion $= \dfrac{actual\ energy\ absorbed\ by\ ice}{actual\ mass\ of\ ice\ melted}$.

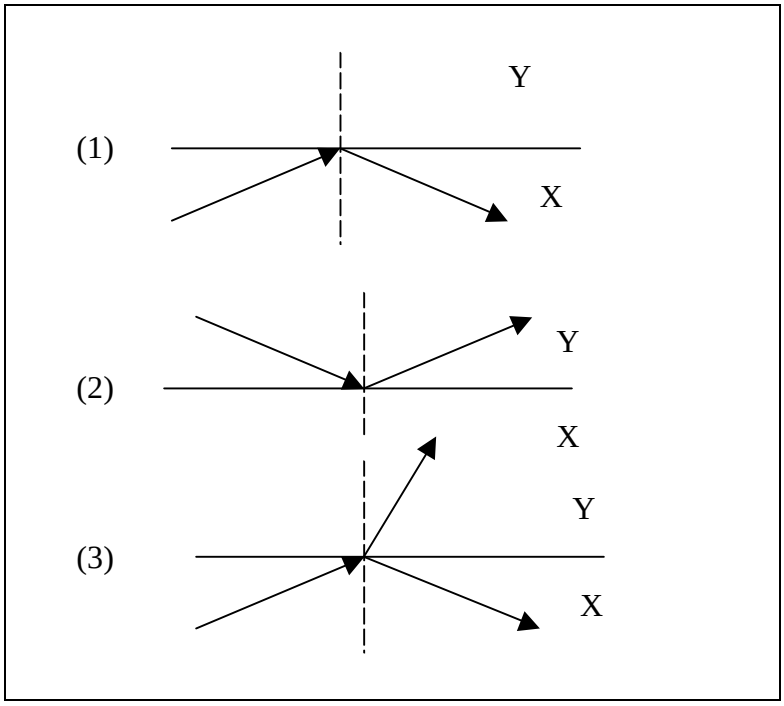
Experimental value = $\dfrac{Pt}{measured\ mass}$

(1) Incorrect. Pt > actual energy, so the experimental result is higher than the actual value

(2) Incorrect. Measured mass < actual mass, so the experimental result is higher than the actual value

(3) Correct. Pt is smaller than (actual power)t

1984MC(46)



$n_X > n_Y$

Total internal refraction occurs only when a beam of light enters a medium of smaller refractive index.

(1) is possible because light goes from a medium of larger n to a medium of smaller n.

(2) is impossible.

(3) is impossible. When light enters a medium of smaller medium, it should bend away from the normal.