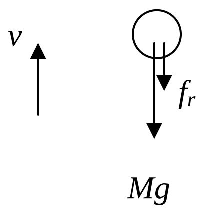
AL Physics MC Answers

Year:1996

Question Number: 4,6,14,18,20,21,24,25,27,37,39,40,42,43

1996MC (4). Air resistance (f_r) opposes motion. Its value is proportional to speed

When the stone is thrown upward:

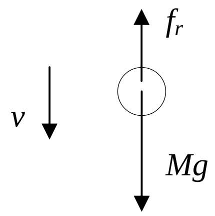


Net force $F = Mg + f_r$ (downward)

$a = F/M = g + f_r/M > g$

As the stone goes upward, its speed decreases, *fr* decrease, *a* decreases and finally equals to *g* at the highest point.

When the stone is falling:



Net force $F = Mg - f_r$ (downward)

$a < g$.

As the stone gains speed when it falls down,

$f_r \longrightarrow Mg$, so $a \longrightarrow 0$

Then, the stone falls at a constant speed (terminal velocity).

1996MC (6) Original momentum = mu, original kinetic energy = $mu^2/2$

	X	Y	Z	Momentum	KE
A	0	0	u/2	mu	$mu^2/4$
B	0	u/3	u/3	mu	$mu^2/6$
C	-u/3	0	2u/3	mu	$mu^2/2$
D	0	-u/3	2u/3	mu	$mu^2/2$
E	u/4	u/4	u/4	mu	$mu^2/8$

The collisions are perfectly elastic, both the total momentum and kinetic energy are conserved.

A, B and E are impossible.

D is also impossible because Y moves backward but X is stationary!

1996 MC(14)

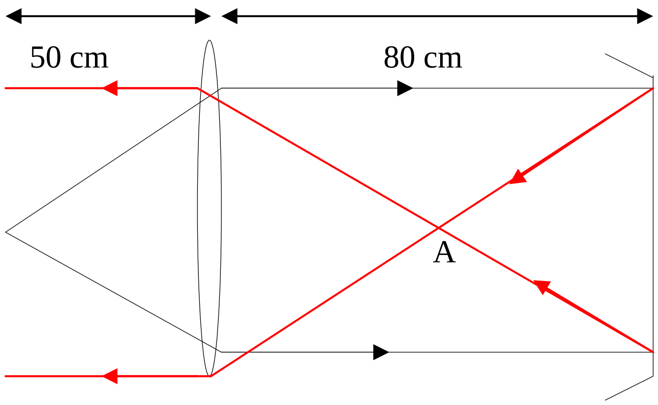
Condition for destructive interference 2d = mλ.

$$2(x\alpha) = m\lambda$$

$$2(\Delta x)\alpha = (\Delta m)\lambda$$

$$\alpha = \frac{(\Delta m)\lambda}{2\Delta x} = \frac{(96-6)589\times10^{-9}}{2(15.8\times10^{-3})} = 0.00168\ rad = 0.096^0$$

1996MC (18)



The final emergent rays are parallel, so the rays must follow the paths shown in the above figure.
The red rays correspond to those after the reflection by the concave mirror.
A must be the focal point of the convex lens and the concave mirror, so the focal length of the concave mirror = 80 – 50 = 30 cm
[Compared to telescope: the two lenses are afocal and the final image is formed at infinity]

1996MC (20)

Beat frequency = $f_2 - f_1 = \frac{2v}{c} f = \frac{2c}{\lambda}$

V = 100 km h^{-1} = 100000/3600 = 27.78 ms^{-1}

Min beat freq = $\frac{2(27.78)}{0.03} = 1900 Hz$

1996MC (21)

Energy stored in cap = $\frac{1}{2}CV^2$

The cap is connected to the source, so V is unchanged.

The capacitance of a parallel-plate cap = $\frac{\varepsilon_0 A}{d}$

Therefore, energy stored in cap $U \propto \frac{1}{d}$

As d increases from d_0, U decreases (A or D).
D is incorrect because the relationship between U and d is not linear.

1996MC (24)

The galvanometer shows null deflection.

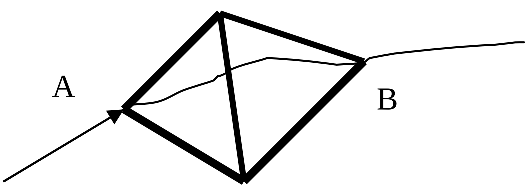
Therefore, the p.d. across 1 kΩ = 3V

Current through 1 kΩ = current through 2 kΩ

The p.a. across 2 kΩ = 6 V

The e.m.f of the battery = 9 V

1996 MC (25)



Path ACB and ADB are exactly identical, so p.d. across AC = p.d. across AD

C and D are at the same potential, so p.d. across CD = 0

No current passing through CD, so wire CD can be removed from the network.

After the removal, the network becomes a parallel connection of AB (1 Ω), ACB (2Ω) and ADB (2Ω). The total resistance is 0.5 Ω., so the p.d. across AB is 2 x 0.5 = 1 V

The current through ACB is 1/2 = 0.5 A.

1996MC (27)

When the switch is closed, the induced current in the secondary coil will produce its own flux in the core to oppose the original flux change (Lenz's law)

Let the original flux be $\phi_o \cos\omega t$.

Generally, under the influence of the induced current in the secondary coil, the final flux can be written in the form $\phi_1\cos(\omega t + \theta)$, where ϕ_1 is an amplitude and θ is a constant phase. The final rate of change must be smaller, so $\phi_1 < \phi_0$. (1) is correct .

In view of the primary circuit, E = Ir + ε. If the primary coil has no resistance(r = 0), E = ε. The magnitude of the applied voltage (E) is always equal to the induced emf across the primary coil (ε). If ε drops suddenly, the primary current must increase in order to restore ε to its original value [ϕ_0 and ϕ_1 are both proportional to primary current, an increase in primary current will restore ϕ_1 back to ϕ_0]

(2) and (3) are both correct.

1996MC (37)

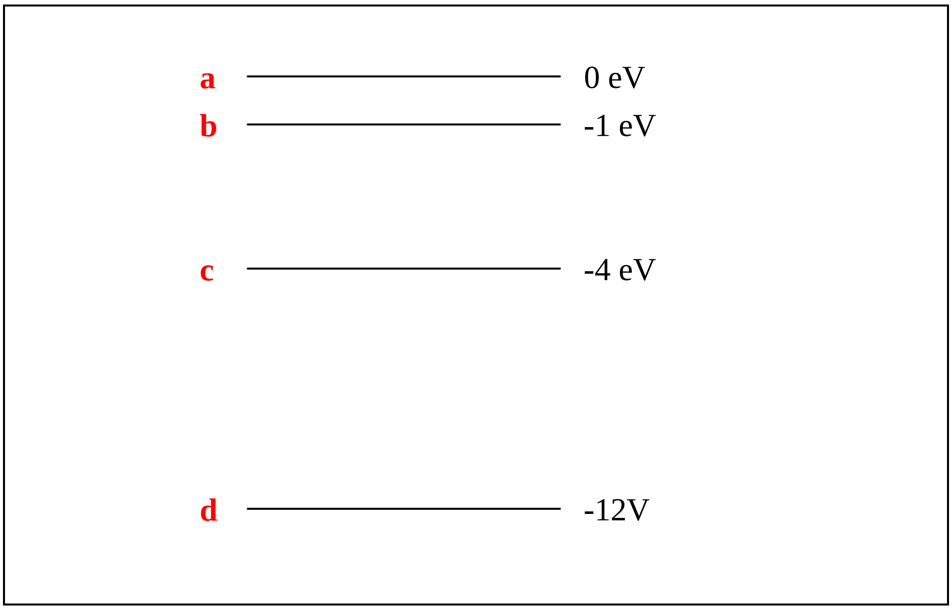
(1) Correct. At a higher atmospheric pressure, water molecules needs more energy to do the work against the atmospheric pressure to escape from the surface.

(2) Incorrect. The average molecular kinetic energy is the same just before and after a change of state since the temperature is kept constant throughout the whole process.

(3) Incorrect. The supplied energy (heat) = increase in internal energy (intermolecular potential energy) + work done to against the atmospheric pressure to expand

In a change of state, the average molecular kinetic energy does not change at all!

1996MC (39)



A. "d" has the lowest energy - most stable state.

B. Jump from "c" to "a", an energy of 4 eV is required.

C. Drop from "c" to "d", a photon of energy 8 eV is released

D. Jump from "d" to "c", an energy of 8eV is required. This amount of energy can be obtained by an inelastic collision with an electron of incident energy greater than 8 eV.

E. Energy cannot be absorbed from two separate events to get the right amount for transition. If the atom is in the state "d", a photon of 4 eV cannot be absorbed by it There is no intermediate state between allowed levels.

1996MC (42)

Maximum KE of photoelectrons = $hf - \Phi$, where Φ is the work function of the metal.

Nothing else, so max KE depends on the work function and the wavelength of the incident light.

A closer light source will produce more photoelectrons, but not their max KE.

1996MC (43)

Definition of binding energy = (Total mass of individual nucleons-mass of the nucleus)c^2

Mass of nucleus = (2 x 1.0073 + 2 x 1.0087 – 28.396/931)u = 4.0015u