PHYSICS 1 2007 - NECTA FORM FOUR

Solutions from: Maktaba by TETEA

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1.

i	ii	iii	iv	v	vi	vii	viii	ix	x
C	B	E	D	D	A	C	A	B	E

2.

i	ii	iii	iv	v	vi	vii	viii	ix	x
H	C	K	A	N	P	E	G	F	Q

3.(a)(i) Relative density is the ratio of density of substance to the density of water.

(ii) Let for methanol,

H_1 = 16 cm, ρ_1 =?,

For water,

H_2 = 12.8 cm, ρ_2 = 1 g/cm^3

Since at equilibrium, inside pressure = outside pressure.

$H_1 \rho_1 g = h_2 \rho_2 g$

ρ_1 = (1 x 12.8)/16 = 0.8 g/cm^3

relative density = 0.8

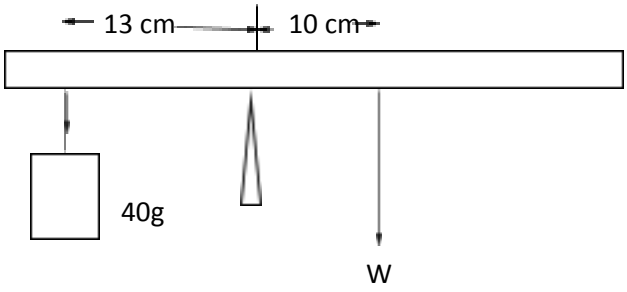
(iii) since h_1 = 21.50 cm, then

H_2 = (0.8 x 21.5)/1

= 17.2 cm

(b)g can be used to denote acceleration due to gravity with SI unit m/s, as the body undergoes free fall.

(c). (i)



(ii)from principal of moments,

W x 10 = 40 x 13

W = 52g

Mass = 52g

4.(a)(i) Upper fixed point is the temperature of steam from boiling water at standard atmospheric pressure of 760 mmHg.

(ii)Lower fixed point is the temperature of pure melting ice.

(b)(i)-It is a good conductor of heat and hence, can measure even high temperatures. It gives results quickly.

-has a fast response time.

-It expands linearly and less than alcohol and any other liquid.

-It is more durable than alcohol thermometer because mercury does not evaporate easily.

(ii) similarities,

-both perform one way measurements.

-both contains steel indices.

Differences.

- The maximum temperature is measured by a thermometer or mercury meter, while the minimum temperature is measured using an thermometer or an alcohol meter.

(c)(i)The thermos flask consists of a double-walled glass vessel resting on a cork inside a metal or plastic case. The outer surface of its inner wall and the inner surface of its outer wall are silvered. This prevents heat transfer due to radiation. The space between the two walls is almost vacuum and the walls are sealed at the top. The double-walled glass vessel and vacuum prevents heat loss by conduction. The insulating stopper or cork at the top minimizes heat loss by convection.

4. (b) (i) temp t1 = 100^0C

Temp of second water T1 = 10^0 C

Mass of the first water = , m1 = 500 g

Mass of second water, m2 = 500g

Final = ? t

From conservation of energy,

M1c1(T1 – T3) = M2c2(T3 – T2)

M1 = m2 and c1 = c2

Then, t3 = (100 + 10)/2

Hence final temperature is 55^0C

5.(a)(i) conditions for total internal reflection

- Light must be passing from dense to less dense medium
- Incident angle should be greater than critical angle of medium.

(ii)An object appears colored when light falls onto the surface of object reflects light of colour falling onto it, and absorbs the rest.

(b) (i)Complementary colors are lights which when added together gives white light.

(ii)Pigments are impure while light is pure.

-pigment colour mixing is termed subtractive colour mix while mixing of colour lights is known as additive colour mixing.

(c) (i) fro u + v = 80 ……. (i)

Also v/u = 3, v = 3u …. .(ii)

Then, u + 3u = 80

U = 20 cm

(ii) from lens formula

1/f = 1/v + 1/u

F = (3 x 20)/4 = 15 cm

6.(a)(i)Charging and discharging are the basic functions of capacitor.

(ii)Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies.

(b)(i)charge will begin to flow from higher potential to lower potential and the energy stored in the capacitor gets converted into heat energy. Therefore, the capacitor will be discharged immediately.

(ii)

(c)Recall that

Energy $E = v^2/R \times t$

But $Q = I \times t$ so $V = (QR)/t$

So $E = Q^2R/t = (10\text{-}6)^2 \times 2/10\text{-}6$

Energy stored is 0.000002J.

(c)(i)charges on the surface of solid conductor of irregular shape is that, it's density is higher on sharp points than other areas.

(ii)On hollow conductor is that, it's density is distributed only in the outside surface.

(iii)On lightning conductor density is higher at the end of the sprikes.

7.(a)(i)factors affecting resistance which are Temperature, Length of wire, Area of the cross-section of the wire, and nature of the material. When there is current in a conductive material, the free electrons move through the material and occasionally collide with atoms.

(ii)From the given diagram,

Effective resistance 2 = 10Q/(10 + Q)

So Q = 2.5 Ohm's

(b)(i)The electromotive force is independent of the circuit's internal resistance. The potential difference is proportional to the circuit's resistance.

(ii)Two identical batteries wired in parallel would give you double the current rating at the same voltage as a single battery.

(c)Area = $0.5mm^2$

From, resistance, R = PL/A

P = RA/l

= (2.2 x 0.5 x 10-6)/2

Resistivity is 0.00000055 ohm-meter

(ii)Recall that, RT = (2.2R)/(2.2 + R)

Hence resistance of wire is 1.83 ohms

Then, length is given by:

L= RA/p = (1.83 x 0.5 x 10-6)/(5.5 x 10-7)

Length is 1.66m

8.(a)-Alpha.have low penetration power

-beta. Have higher penetration power than alpha

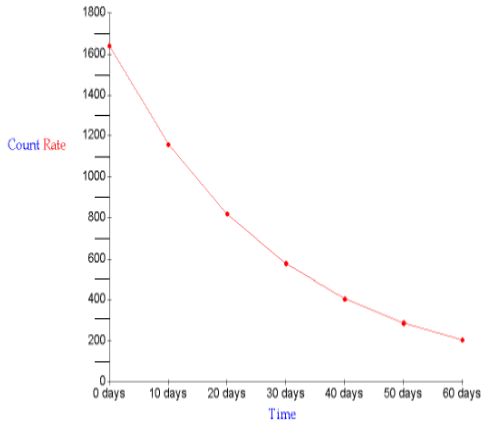
-gamma.have very high penetrating power.

(b)Mass number of an atom is the

sum of the number of protons and neutrons present in the nucleus.

Atomic number of an atom refers to the number of protons present in the nucleus.

(c)(i)THE GRAPH OF COUNT RAYE AGAINST TIME.



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(ii)From then, half life of thoron is 8 minutes.

9.(a)(i)Archimedes' principle states that the upward buoyant force that is exerted on a body immersed in a fluid, whether fully or partially, is equal to the weight of the fluid that the body displaces.

(ii)

From, density =mass/volume so,

Mass = density x volume

= 2700 x 0.04

= 108 kg.

(iii)Apply Archimede's principle,

Upthrust = volume x density x g

= 0.04 x 1200 x 9.8

= 470.4N

So,Apparent weight = real weight - Upthrust

= (108 x 9.8) - 470.4

= 588N

(b)(i) chemical energy into heat,and then mechanical energy.

(ii)chemical energy to electrical energy, then light and heat energy.

(c)Potential energy is the stored energy in any object or system by virtue of its position or arrangement of parts. On the other hand, kinetic energy is the energy of an object or a system's particles in motion.

(i)From, KE = ½ x 0.003 x 400^2

= 420 J

(ii)From, $v^2 = u^2 + 2as$

$400^2 = 0 + 2(a)(0.06)$

Acceleration is -1330000 m/s

Then, Force, F =ma

= 0.003 x (-1330000)

= -4000N

This is negative because it is retardation Force.

10.(a)(i)Ohm's law states that the current through a conductor is proportional to the voltage across the conductor.

(ii)factors affecting resistance which are Temperature, Length of wire, Area of the cross-section of the wire, and nature of the material.

(iii)Recall that, E = I(R + r),

R = (5 x 1)/(5 +1)= 0.833

So, 6= I(0.833 + 0.5)

Current will be 4.5A

(b)(i)The higher the voltage, the lower the current. The lower the current, the lower the resistance losses in the conductors. And when resistance losses are low, energy losses are low also. These considerations make high voltage transmission over long distances an economical solution.

-power lost by AB and CD we consider resistance of cables.

So, power lost = $I^2R = (0.1)^2 \times 4 = 0.04W$.

Then, total power lost = 0.04 x 2 = 0.08W

-from, Ns/Np=Es/Ep

Es = Ns/Np x Ep = 10/1 x 10 = 100V.

So, Each = 100V

Summing the voltages round the path,

100 = 0.4 + 0.4 + Ecd

Hence, Ecd = 99.2 V.

-Also,

Is= Np/Na x Up

= 10/1 x 0.1

Current through the bulb is 1.0 A

(c)The induced e.m.f. is proportional to the number of turns in a coil. The speed at which the conductor moves through the magnetic field. The length of the conductor. The rate at which the conductor cuts the magnetic lines of force.

11.(a)(i)The cathode ray tube is evacuated to a low pressure to avoid collisions of electrons with air molecules.

(ii)The vaccum conditions in the cathode ray tube are maintained in order to avoid the scattering of cathode rays by the gas molecules that would be present in absence of vaccum.

(iii) If the tube is not evacuated , the thermions (electrons) may ionise the air and collide with them . This can cause irregular image on the screen .

(b)(i)to preheat the filament to a specific temperature to generate electrons through thermionic emission.

(ii)to accelerate the electrons through an electrical voltage potential and stopping them in a target.

(iii)Tungsten Target is used to absorb highly energetic elections and emit X-rays.

(c)Are generated as The high velocity electrons collide with a metal target, the anode, creating the X-rays.

(d)(i)The conductor has a large number of electrons for transmission, whereas semiconductor has a very little number of electrons for transmission. The temperature coefficient of a conductor is positive, whereas semiconductor has negative. The conductor doesn't have forbidden gap whereas semiconductor has forbidden gap.

(ii) consider the following graph.