PHYSICS 1 2006 - NECTA FORM FOUR

Solutions from: Maktaba by TETEA

By Yohana Lazaro

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

2.

i	ii	iii	iv	v	vi	vii	viii	ix	x
T	N	I	B	J	I	D	R	S	F

3.(a)given mass of rocket, m = 200kg

Rate of flow of exhaust, R = 25kg/s

Velocity of exhaust gas, v = 100 m/s

(i)By Newtons second law of motion;

Force = $\Delta mv/t$

But $\Delta m/t$ = 25kg/s

v=100 m/s

Force = 25 x 100

Force = 2500 N

(ii)acceleration = force/mass

=2500/200

= 12.5 m/s^2

(b)Where 100 kg have been burn, there remains

Mass, m = 200 – 100

A = F/m

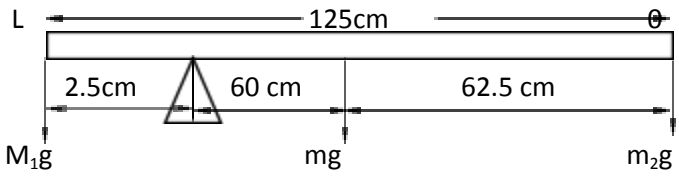
= 2500/100 = 25m/s^2

(c)Length of bar L = 125cm, mass of a bar = 5 kg

Mass at the end of the short bar, m_1 = 320 kg

Point of pivot, p = 2.5 cm

Let mass at the end of the long = m_2



From principle of moments;

Sum of clockwise moments = sum of anticklwise moments

(5 x 10) x 60 + 122.5 x m_2 x 10 = 2.5 x (320 x 10)

Hence, m_2 = 4.08 kg

4(a)(i)Light is refracted when it passes from one medium to another because it changes its velocity.

(ii)the image will be formed at the principle focus.

(iii)A blurred image occurs when light rays passing through the lens are not brought to the same focus.

(b)(i)conditions giving rise to critical angle and total internal reflection are;-

- Light travels from dense mediumto a less dense medium
- The angle of incidence must be greater than the critical angle.

(ii)two principle of physics used to make telescopes are;

-reflection

- refraction

(c) given focal length f = 18m

U = 1.5 x 10^{11} m

Diameter = 1.4 x 10^{9}

V = 18 cm

Hence object is 18 cm from the reflector

Then, magnification = image distance/object distance

= v/u

$=18/(1.5 \times 10^{11})$

$= 1.2 \times 10^{-10}$

Again,magnification = d'/d

$1.2 \times 10^{-10} = d'/1.4 \times 10^{9}$

$d' = 0.168m$

hence, the imge is 16.8 cm wide.

5(a)(i)Ampere is the current that if flowing in two infinitely long straight conductors placced 1m apart in vacum will produce on each of the wirws a force of 2×10^{-7} N per metre length.

(ii)Coulumb is the quantity f charge which passes any point of a conductor in one secondwhen a steady current of 1A is flowing.

(iii)Volt is the potential difference between two points in a circuit .

(iv)Ohm is the resistance of a conductor such that when a potential difference of 1V is applied ti its ends a current of 1 ampere flows through it.

(b)(i)Ohms law states that “at constant physical conditions, the current flowing through a conductor is proportional to the potential difference between its ends”

Limitations of ohms law

-it does not hold to semiconductors

-it does not hold to electrolytes

It does not apply to conductors electricity of gases

(ii)given emf E = 1.5V

Resistors 10Ω

Let internal resistance be r

From $E = I(r + R)$

$E = I(r + 10)$

But $I = V/R = 1/10 = 0.1A$ so,

$1.5 = 0.1(r + 10)$

$r = 5\Omega$

when R is connected,

From $E = I(r + R)$

$I = V/R = 0.5/R$

Then, $1.5 = 0.5/R(5 + R)$

Hence $R = 2.5\Omega$

(c) mass of liguid m = 200g = 0.2kg

$T1 = 21^0C$

$T2 = 51^0C$

Ten heat gained by liquid = $mc\Delta t$

$= 0.2 \times C \times (51 - 21)$

$= 6C$

-heat supplied = Ivt

$= 5 \times 6 \times 300s = 9000J$

Since heat supplied = heat gained

$6C = 9000$

Hence specific heat capacity = 1500 J/kg K

6(a)(i)Heat vs Temperature

- Heat is the form of energy which transfers from one point of the body to another due to temperature difference etween the points while temperature is the measure of degree of hotness or coldness of the body.
- Heat flows while temperature does not flow
- Heat is measured in JOULES while temperature is measured in CELCSIUS degrees,kelvin

(ii)Anomalous expansion of water is the behaviour of water to expand if it is cooled below -4^0c

This behaviour makes ice to float on water.it balso enables to support the life of aquatic organisms because as water cools below 4^0c, it rises leaving the bottom much warmer and forming a layer of ice on the surface insulating the water below it against further cooling.

(b)(i)A gap is left between two successive rails in order to allow expansion of the rails when temperature rises.

(ii)A glass tumbler breaks when a hot liquid is poured in it because the thinner wall expands quickly while, deu o poor conductivity of glass, the outer wall remains unexpanded.

(c)Coefficientof linear expansivity is the fractional increase in length per degree centigrade rise in temperature.

Given length l = 100 cm

Initial temperature, $t1 = 15^0C$

Final temperature $t2 = 100^0C$

Also given that, $\Delta l/l = 0.15\%$

But , $\Delta l = \alpha l \Delta t$

$\alpha = \Delta l/l \times 1/\Delta t$

$= 0.15/100 \times 1/(100 - 15)$

Hence, $\alpha = 1.76 \times 10^{-5} /^0C$

7(a)(i)Metal plates are placed for focusing emitted particles.

(ii)the radiations contains beta particles

Since average background count = av. Of the four readings

Background count = $\frac{26+28+26+28}{4}$ = 27 counts/minute

(iii)Background count is the radiation present in the environment even when there is no apparent radioactive material around.this count rate is caused by cosmic rays and presence of radioactive rocks and particles in the ground.

(c)(i) initial count rate C_0 = 1200 count/min

Final count rate, C= 150 count/min

Time taken t = 15 hrs

Let half life be $t_{1/2}$

Since count rate α number of atoms remained (N)

C_0 α N_0

Mathematically;

$C_0/C = N_0/N$

After 1 half life,N = ½ N_0

Then,

$C_0/C = N_0/½ N_0$ $C = C_0/2$

After 2 half life C = ½ $(C_0/2) = C_0/2^2$

So generally after n half life, $C = C_0 2^{-n}$

As C = 150 count /min

$150 = 1200/2^{-n}$

So n= 3

But 15 hr = 3 x $t_{1/2}$

So $t_{1/2}$ = 5hrs

Hence, half life of the element is 5 hours.

(ii) given initial number of atom $N_0 = 3 \times 10^{20}$

Time t = 25 hrs

BUT $N = N_0 2^{-n}$

Also n = time /half life

= 25hrs /5 hrs

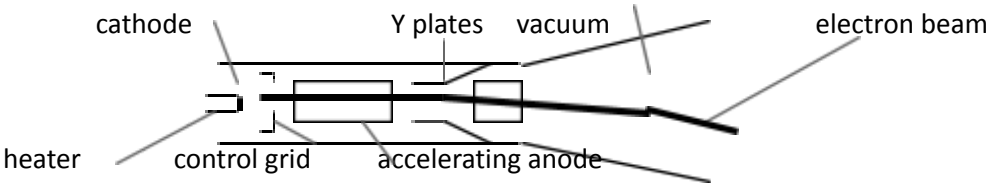
= 5.

Then $N = 3 \times 10^{20} \times 2^{-5}$

$= 9.375 \times 10^{-18}$ atoms

8(a)(i)In a conductor, the conductor and valence bands overlap, while in semiconductor the conduction band is empty at absolutely zero temperature, but electrons gain energy they can jump across the forbidden gap to the conduction band.

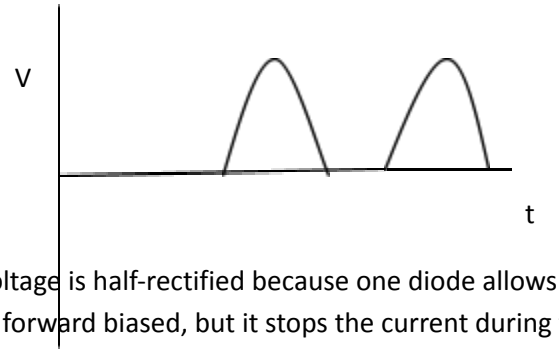
(ii)When an electric field is applied to the cathode ray beam in the CRO thebeam is deflected towards the positive terminal.



-When the magnetic field is applied to the cathode rays beam, the beam is deflected according to Flemings left hand rule.

(b)(i)A diode is a device that allows electric current to flow in only one direction

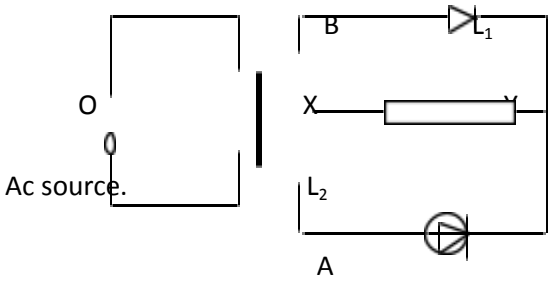
(ii) The current is a half wave rectifier.



The output voltage is half-rectified because one diode allows current t flow during the first half of the cycle when it is forward biased, but it stops the current during the second half as it acts as reverse biased.

(c)Full wave rectification with two diodes is achieved by using a centre-tap transformer. From the diagram below, when B is positive with respect to X, the current flows around loop L_1, and from Y to X.On the next cycle A is positive with respect to X, in which case the current flows around loop L_2, again from Y to X . Therefore as long as the load is concerned the current flows in one direction Y to X in both cycles. This process is so called **full-wave rectification**.

Diagram to show full wave rectifier using two diodes.



9(a)(i)Triple point of water is the temperature at which three states of water are all in equilibrium

(ii)Specific latent heat of fusion is the amount of heat required to change the solid state of 1kg of substance to liquid at constant temperature.

(b)-Evaporation takes place at all temperatures while boiling occurs at a specified temperature under given pressure.

-evaporation occurs at the surface of liquid while boiling occurs through the volume of a liquid.

(c) Initial temperature of water, t_1 = 290K

Time to reach oiling point t_1 = 2min

Time to boil away, t_2 = 12 min

Boiling point of water = 373 K

Specific heat capacity of water, C = 4200J/Kg K

Let specific latent heat of steam = L

From, power = $\frac{heat\ enery}{time\ taken}$ also Heat = mCΔt

So, power = $\frac{m\ x\ 4200\ x\ (373-290)}{2\ min}$

Power = 174300m

Also heat required to boil water = mL

Power x time = mL

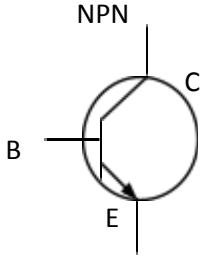
174300 x 12 = mL

On solving, L = 2091600 J/kg

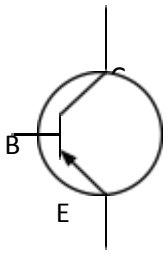
10(a)(i)Magnetic induction is the process of producing magnetism in a non-magnetized material when it is placed in a magnetic field.

(ii)Magnetic screening is the shielding of magnetic field from a certain region by surrounding the region with a magnetic material, e.g. iron ring.

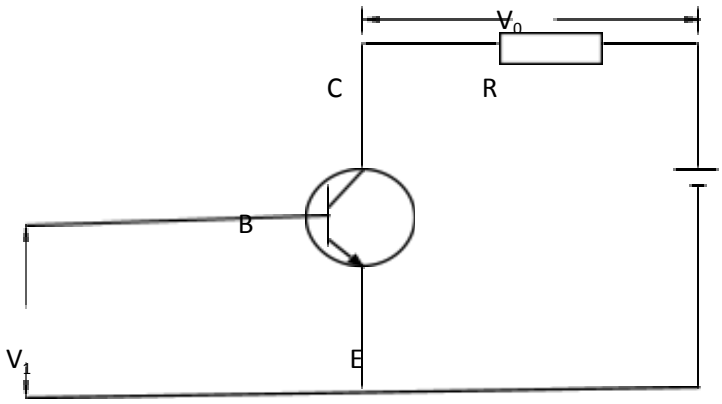
(i) NPN



PNP



(ii)NPN transistor amplifier.

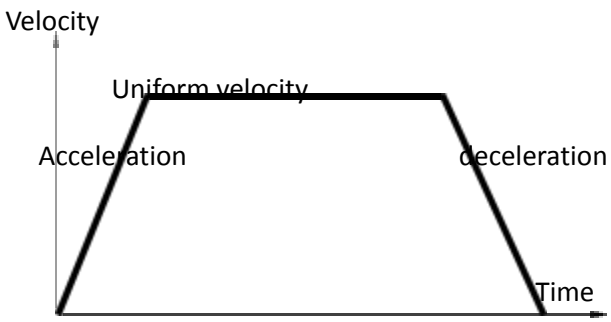


11. (a)(i)Speed is the rate of changing distance without specified direction, Velocity is the rate of changing distance at a specified direction.

(ii)Uniform velocity is the motion with zero acceleration in a given direction

Uniform acceleration is the constant rate of changing velocity.

(b) velocity-time graph.



(c)-initial velocity, u = 100 m/s

-final velocity, v = 0 m/s

Acceleration, a = - 2.5 m/s^2

(i) Recall that, v = u + at

0 = 100 + (- 2.5)t

Hence time t = 40 seconds

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

$0 = 100^2 + 2(-2.5)S$

S = 2000m

Hence distance = 2000 m