PHYSICS 1 2004 - NECTA FORM FOUR

Solutions from: [Maktaba by TETEA](https://maktaba.tetea.org)

By Yohana Lazaro

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

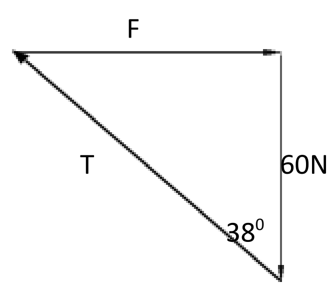
2.

i	ii	iii	iv	v	vi	vii	viii	ix	x
R	B	O	C	E	Q	T	I	F	P

3(a)(i)parallelogram law of forces states that “if two forces are represented in both magnitude and diraction by adjacent sides of a parallelogram, then their resultant force is represented in magnitude and diretion by the diagonal of the parallelogram”

(ii)given weight, W = 60 N., angle = 38^0

Consider the figure below by applying the addition law of forces



Cos 38^0 = 60/T

Tension = 76.14N

Also; tan 38^0 = F/60

Hence horizontal force = 46.88N

(b)(i)The principle of conservation of momentum states that “when two bodies colliding, their total momentum before collisions is always equal to total ,momentum after collision”

(ii) given m_1 = m_2 =m=M (let say)

U_1=120m/s

U_2 = 200m/s

Required common final velocity v

Recall that m U_1 + m U_2 =(m + m)v

120 – 200 = 2v

V = -40 m/s.

Common final velocity of the two bodies will be 40 m/s in opposite direction of the initial direction.

(c)Since, in the block and tackle pulley system,

Velocity ratio = number of pulleys in the system

Hence number of pulley is 4 for velocity ratio of 4.

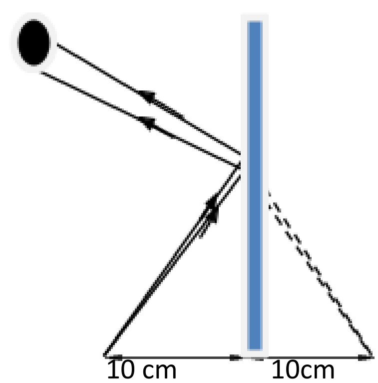
4.(a)(i) **A** is objective lens.since it has longer wavelengh than the other lens, hence focal length , f = 100cm

(ii)Image of the distant object is formed at the focus,

(iii)**B** is called eyepiece lens

(iv)image of **A** acts as the object for image **B**,then the object must be a the focus of **B** so distance of **B** is 5 cm away.

(b) consider ray diagram below: -



(i)the image is said to be virtual because; -

-it cannot be formed on the screen

-there is no actual intersection of light rays when the image is formed.

(c)when the light is incident at critical angle' it is refracted at 90^0

Recall that

${}_g\eta_a$ = sin C/ sin r $\Rightarrow$ 1/ ${}_g\eta_a$ = sin C /sin r

sin C = sin 90^0/1.55 = 0.6452

C = $\sin^{-1}$0.6452

Hence critical angle C is 40.2^0

5.(a)(i)The Fundamental interval of a temperature scale is the difference in length between the two fixed points .

(ii)Apparent volume expansivity is the fractional increase in volume of water by which water appears to expand per temperature rise by 1 K.

(iii)Anomalous expansion of water is the tendency of water to expand as it cooled below -4^0C

(b)(i)gases have lower specific heat capacity than liquids.

(ii)Alcohol has a lower freezing point than mercury.

(iii)A thick wall will conduct less heat to the interior than a thinner wall.

(c)(i) the level of liquid being heated in a vessel first fails before starting to rise because the vessel expands first before the liquid.

(ii)give, ice point = 80^{0CC}

Steam point = 0^0C

Let temperature between 0^0 and 50^0 be a

0^0 and 80^0 be b

0^0 and 100^0 be c

Also let temperature registered at 50 ^{0}C be t

Then, a/c x 100 =50…………(i)

b/c x 100 = 80…………(ii)

take i/ii

$$\frac{a/c \;x\; 100 = 50}{b/c\, x\, 100 = 80}$$

x/y = 50/80 so,

t = x/y x 100

= 50/80 x 100

Hence required temperature registered is 62.5

6. (a)factors affecting capacitance

- Area of the plates
- Separation distance between plates
- Strength of the dielectric material

(b)given capacitance , C = 470 x 10^{-6} F

Voltage, V = 10v

Let quantity of charge required be Q

Recall that, Q = CV

= 470 x 10^{-6} F x10v

Hence Q = 4.7 x 10^{-3} C

(c)(i)The plane may be charged after a long flight due to friction with air as well as clouds.

(ii)Passengers in the plane are not charged because there is an insulation between them and the metal body of the plane.

7(a)(i)beta and gamma rays

beta particles	Gamma rays
-deflected by electric and magnetic field	-not deflected by electric field
-penetrate few centimeters of aluminium sheet	- penetrate few centimeters of lead
-are electrons	-are electromagnetic radiation
-have mass	-have no mass

(ii)

X rays	White light
-cannot be detected by human eyes	Can be detected by human eyes
Have variable range of frequency	Have fixed frequency range

-highly penetrative	Can penetrate transparent and translucent materials only

(b)(ii) given half life $t_{1/2}$= 1600 yrs

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

As N = number of atoms present

N_o = initial number of atoms

N = number of half life

Then $n = t/t_{½} = 6400/1600 = 4$

Then $N = N_o 2^{-4}$ or $N/N_0 = 1/16$

(c)(i) $^{213}_{84}Po \longrightarrow {}^{209}_{82}pb + A_b^a$ comparing

213 = 208 + a, a = 4

84 = 82 + b, b = 2

(ii)$^{209}_{82}$ Pb $\longrightarrow {}^{d}_{c}Bi + e^{0}_{-1}$

209 = c + 0, c =209

82 = d - 1,d = 83

(iii)from (i) A is the alpha particle.

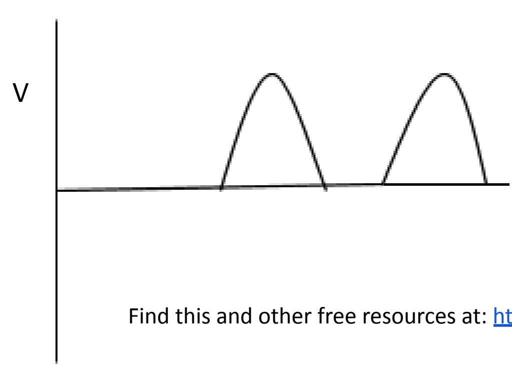
8. (a)(i)Two semiconductors widely used in electronics are silicon and germanium

(ii) P – N junction diode

(iii) The circuit 1 will light a bulb because the diode is forward biased.

(b)(i) Rectification is the process of converting an alternating current to direct current.

(ii)The current is a half wave rectifier.



t

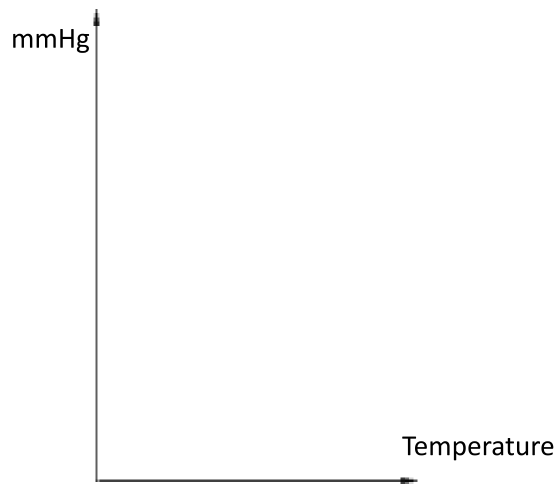
The output voltage is half-rectified because one diode allows current t flow during the first half of the cycle when it is forward biased, but it stops the current during the second half as it acts as reverse biased.

9(a)(i)Saturated vapour is the vapour which is in equilibrium with its liquid or solid.

(ii)Unsaturated vapour is the one that is not reached the state of dynamic equilibrium with its own liquid or solid.

(iii)Dew point is the temperature at which the water vapour present in air is just enough to saturate it.

(b)From the given data, the graph is as shown below:-



From the graph,

-vapour pressure of water in a room where dew point is 8^0C is 4mmHg

-Boiling point of water at a pressure of120mmHg is 55^0C

(c)

11(a)(i)Thermionic emission is the process whereby a metal emits electrons as a result of being heated.

(ii)in CRO, electrons are released from the cathode by thermionic emission.then, electronsare accelerated and focused by a system of anodes to form a narrow beamof high speed electrons.

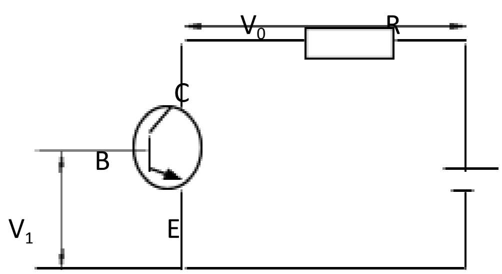
(iii)Principle of transistor;The transistor is essentially made of two pieces of either N-type or P-type material,sandwiching one piece of the other type.the end pieces are used as collectors and emitters while the middle piece is used as base.in order a transistor to operate, a small amount of current is passed from the base to emitter or reverse.This small curent starts a much large current from the collector to emitter through the base or its reverse.

(b)(i)To ensure that electrons produced do not accumulate at the source, the device has anodes for accelerating the electrons from the source.

(ii)For the electrons to reach their target undeviated, the device s have a focusing anode.

(iii)The devices using the thermionic emission principle are evacuated so that electrons travel without collide with other particles on their way to target.

(c)(i)NPN as amplifier.



(ii)NPN TRANSISTOR AS A SWITCH

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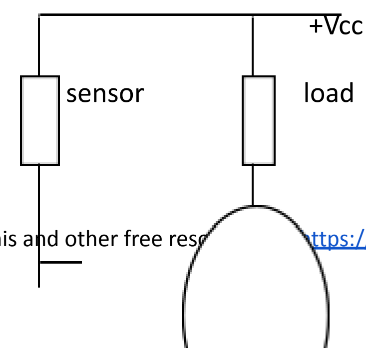

R_2 R_L