PHYSICS 1 2012 - NECTA FORM FOUR

Solutions from: Maktaba by TETEA

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1.

i	ii	iii	iv	v	vi	vii	viii	ix	x
C	A	B	B	B	D	A	NO ANSWER	D	E

2.

i	ii	iii	iv	v	vi	vii	viii	ix	x
D	M	B	G	I	M	L	A	B	H

3.

   i.   REFRACTION

   ii.   COUPLE

  iii.   TEMPERATURE

  iv.   REVEBERATION

   v.   ALPHA PARTICLE

  vi.   THERMOPILE

 vii.   SERIES

viii.   EARTH AT THE CENTRE OF OTHER HEAVENLY BODIES

  ix.   WAVELENGTH

   x.   FOCUS OR HYPOCENTER

4. (a) because when immersed in a liquid, it experiences an upthrust force.

(b)(i) mass of hydrometer = mass of water displaces

$$27g = m \text{ mass of water displaced}$$

Volume of water = $27cm^3$

Volume of hydrometer = $27cm^3$ + volume of stem out of water

$$= 27cm^3 + A_{stem} \text{ x } 4cm$$

$$= 27 + 0.75 \text{ x } 4$$

$$= 30 \text{ } cm^3$$

Relative density of hydrometer = 27/30

$$= 0.9 \text{ } cm^3$$

(c)(i) Resolution of forces is the process of breaking down a vector into two components which are perpendicular to each other.

(ii)

1N   2N
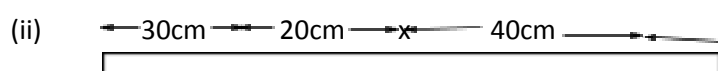
Clockwise moments about x = 40 x 2 = 0.8 Nm

Anticlockwise moments = 20 x 1 = 0.2 Nm

For rule to balance, clockwise moments = anticlockwise moments

$$0.8 = 0.2 + A$$

A= 0.6 Nm

Hence, for a rule to balance we need an anticlockwise moment of 0.6Nm

So, A = 3 x distance

0.6 = 3 x distance

0.6/3

= 20 cm

Hence, 3N force must be applied 20 cm from the pivot or at the 70cm mark.

5. (a)(i) A Newton is the force which can cause an acceleration of $1m/s^2$ when applied to the body of 1 kg mass.

(ii)Inertia is the tendency of the body to remain on state of rest or uniform motion.

(iii)Linear momentum is the product of mass a body and its linear velocity.

(b)(i) given, v = 10m/s, u = 20m/s, a = $-10m/s^2$

-from v = u + at

10 = 20 + -10 x t

Time, t = 1 second.

(ii)given, u = 20m/s, g = $-10m/s^2$, t = 35

From, v= u + at

V = 20 + -10 x 3

V = - 10m/s

Hence first stone will be moving at 10m/s downward.

(c) (i)Let velocity be v

From, conservation of linear momentum,

Momentum before collision = momentum after collision

0 = 2 x 60 + 3 x v

V = -40 m/s.

Hence, part B will be moving at 40 m/s in opposite direction.

(ii)Total KE = ½ mv$^2_1$ + ½ mv$^2_2$

$$=1/2 \text{ x2 x } 60^2 + ½ \text{ x 3 x } 40^2$$

Total kinetic energy = 6000J

6. (a)(i) Gas molecules in a container are continuously in motion, as a result, they collide with themselves and with the walls of the container. As they hit the walls of container, they exert a force on the wall. The average forces of these particles per surface are of the container determines the gas pressure.

(ii)Rubbing the inside of a canvas of a tent in wet weather will cause water to drip on you. This is because the difference in temperature between the inside of the tent where it is warm. Due to surface tension, the sizes of these droplet are small and so remain on the canvas.

(b)phenomena involving surface tension

-When a needle is carefully placed on water it does not sink. This is because if the surface of water is not broken, it can hold the needle without sinking.

-Certain insects can walk on water due to surface tension of water.

(c)(i) Surface area of oil drop = surface area of the film.

$4π = 0.2\text{m}^2$

$R^2 = 0.2/4π$

$R = \sqrt{0.2/4π}$

But, length of drop = d = 2r

$D = 2\sqrt{0.2/4π}$

(ii)Assumptions,

-drop is spherical

-no energy changes

7. (a)(i) Resistance is the opposition that a conductor offers to the flow of electric current through it.

Resistivity is the resistance of the conductor per unit length and unit cross-section area.

(ii)NO. Because parallel connected cells each of the same voltage have a total voltage equal to the voltage of one cell and so the pair will give the same potential difference and current as one cell when connected to a resistor.

(b)(i) One kilowatt hour is a unit of electric energy equal to the energy consumed by an appliance at a rate of one joule per second for one hour.

(ii)60W, 240V means that when the bulb is connected to 240V supply it will use energy at a rate of 60J in one second.

(c) Power consumed = 5 x 60 + 4 x 100

$$= 300 + 400$$

$$= 700W$$

Energy consumed = 700W x 8hours

$$= 5.6kW \, hr$$

Cost = number of units x cost of a unit

$$= 5.6 \times 27$$

$$= 151.2 \text{ shillings}$$

8. (a)(i) Global warming is the increase in surface temperature of the earth due to increase in the amount of greenhouse gases such as carbon dioxide in the atmosphere.

(ii)Greenhouse effect is the ability of the earth's atmosphere to retain heat on the earth even when the sun is not above the area.

(iii)Earthquake is a suddenly violet shaking of the earth crust caused by sudden movement of rocks in the earth crust.

(b)Effects of global warming

i.   Increase in earth's surface temperature.
ii.   Melting of polar ice caps.
iii.   Loss of snow-capped mountains like Kilimanjaro.
iv.   Rise in the level of water in the seas.

(c)(i) The major caused of global warming is POLLUTION OF THE ATMOSHERE by greenhouse gases like carbon dioxide.

(ii)controlling global warming

● Planting trees
● Reducing industrial emissions
● Reducing the use of fossil fuels such as coal and petroleum.

9. (a)(i) Binding energy is the energy required to separate protons and neutrons in the nucleus of an atom.

(ii)Thermonuclear fission is the process of using extremely high temperature to bring about the fusion of atoms.

(b)(i) Background count is the ionizing radiation present in our environment due to emission from outer space or radioactive substances present in our environment.

Sources; -

-outer space

-Radioactive rocks inside the earth.

(ii)As the temperature of a metal increases the rate at which electrons leave the metal surface increases since electrons increase with temperature.

(iii)Amount at time $t = (A_0) \, (1/2)^{t/t1/2}$

$$= (400)(1/2)^{40/8}$$

$$= 12.5g$$

Hence 12.5g will remain undecayed.

(c)(i) $^{226}_{88}X \longrightarrow ^{A}_{B}Y + ^{4}_{2}\alpha$

A = 226 – 4 = 222

B = 88 – 2 = 86 protons

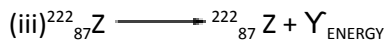Neutrons = 222 – 86 = 136

(ii)$^{222}_{86}Y \longrightarrow ^{C}_{D}Z + ^{0}_{-1}\beta$

D = 86 + 1 = 87

C = 222 – 0 = 222

Neutrons = 222 – 87

= 135

Hence, composition of nucleus is 87 protons and 135 neutrons.

(iii)$^{222}_{87}Z \longrightarrow ^{222}_{87}Z + \Upsilon_{ENERGY}$

Composition of the nucleus is 87 protons and 135 neutrons.

10. (a)(i) A transistor is a semiconductor device which is used in electronic circuit to work as either switch or amplifier.

(ii)Applications of transistors

- As switches in electronic circuits
- Amplification of signals
- Oscillators
- Control circuits.

(b)(i) types of diodes

- Vacuum tube diodes
- Semiconductor diodes
- Zena diodes
- Light-emitting diodes.

(ii)Mode of action of a forward biased p-n junction

-Forward bias occurs when the p-type section of a diode is connected to the positive terminal of a battery and the n-type section to the negative terminal.

(c) (I)It is named common-emitter because the emitter is common to both the base circuit and the collector circuit.

(ii)Role of capacitor C1 is to isolate DC from input signal.

Role of capacitor C2 is to filter out DC components in the output signal.

11. (a)(i) A manometer is used to measure gas pressure.

(ii) A hygrometer is used to measure the density of a liquid

(iii)A barometer is used to measure atmospheric pressure.

(b)(i) A siphon is a device used to control the release of water from a flash tank.

(ii)mechanism of a siphon,

-siphon is **a tube that allows liquid to travel upward**, above the surface of the origin reservoir, then downwards to a lower level without using a pump. When a certain amount of water moves over the bend in the siphon, gravity pulls it down on the longer leg lowers the atmospheric pressure in the bend of the siphon.
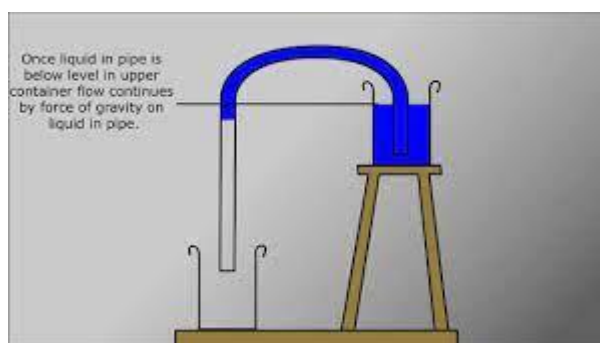
(c)(i) A bubble increases volume as it rises from the bottom of a pond to the surface as it rises the surrounding pressure decreases and so the pressure inside the bubble expands the bubble outwards.

(ii)Since the column of air inside the tube has changed from 1m to (1 – 0.2 = 0.8m) its volume has changed from V_1 to $0.8V_1$

-Apply Boyle's law,

$P_1V_1 = P_2V_2$

ATM X V_1 = P_T X $0.8V_1$

P_T = 1.25ATM,   ATM = Atmospheric pressure.

-As pressure at A = pressure at B

pressure at A = 125ATM

pressure at B = density x g x distance X between two points A and B.

So, 1.25 ATM = density x g x X + ATM

X = 0.25 x 0.76mHg

X = 0.19m

Hence, depth of the open end inside mercury is 0.19m + 0.2m = 0.39m