MUHANGA DISTRICT DATE …18../03/2024

CLASS: 5S

COURSE:PHYSICS. …MARKING SCHEME……

1.a) Amplitude (A) :Maximum displacement of a body undergoes SHM from the rest position. **1mark**

Its SI unit is m. **1mark**

Period (T) :A time required to make a complete cycle. **1mark.**

Its SI unit is sec. 1 mark

Frequency (f) : Number of a complete cycle per unit of time **.1mark**

Its Si unit is hertz. (Hz) **1mark**

b) Data: frequency f=3Hz

Amplitude A= 0.2m

Initial speed V=4m/s

Let X(t)=a sin (wt+Φ) be the displacement then the speed $\dot{X}(t)$=awcos(wt+Φ), by using numerical replacing we get

0.2 m=0.2m sin(6π*0+Φ) (1)and **0.5mark**

4m/s=0.2x6π cos (6π*0+Φ) (2) **0.5mark**

From these two equation we obtain tan Φ=0.9 then Φ=43.3^0=0.24π **1mark**

The position as function of time X(t)=0.2 sin (6πt+0.24π) **2marks**

b) At time 0 a body is at maximum position which is a turning point i.e that other first turning point will -0.2m, then -0.2m=0.2 sin (6πt+0.24π)(**1mark)** by solving we get t=0.2099sec (**1mark)**

The acceleration at this time $\ddot{X}=-w^2X$=-$(6\pi)^2$(-0.2)m/s^2=71m/^{2} **2marks**

2.i)Kirchhoff"s laws:

1st law(Junction's law): The algebraic sum of electrical current meeting a junction is equal to zero (**1.5 marks)**

2nd law(Voltage's law): The algebraic sum of electromotive forces and voltages drop around a closed loop is zero. (**1.5marks)**

ii)The 1st law expresses the conservation of **charge** **2marks**

iii)The second law expresses the conservation of **energy** **2marks**

iv) The current through resistance I=0.775A for 18 Ω, I=0.194A for 45Ω and I=0.581A for 15Ω

3marks.

3. a) Resonance :A phenomenon in which oscillating system oscillates at maximum displacement **2marks**

b) Negative effect of resonance is a destruction of oscillating system

Example Collapsing of a house during Earthquake **1mark**

C)Data : length of a string l=3m

Density μ=0.0025 kg/m

F_n=252 Hz=$\frac{nv}{2l}$ (**0.5 mark**) **(1)** and f_{n+1}=336 Hz=$\frac{(n+1)v}{2l}$ (**0.5 mark**)(**2**)sequence of resonance frequency of a string fixed at both ends fn=n$\frac{V}{2l}$ Then by dividing(**1)** and (**2) we obtain n =3 1mark**

Fundamental frequency f_0=$\frac{v}{2l}$=256 Hz/3 =84 Hz

Speed of wave v=2lf_0=2X3mX84 Hz=504m/s **1mark**

Speed of wave v=$\sqrt{\frac{T}{\mu}}$ **1mark**

T=μ.V^2=0.0025kg/m*(504m/s)^2=635.04 N **1mark**

4.A) Climate change is the change of weather conditions for a long period while **climate change mitigation** refers to measure taken in order to reduce the negative impacts of climate change **4marks**

B)Measures taken to mitigate climate change:

Recycling some material that can be harmful to environment

To promote public transport

To create protect area like forests and swamps

To create board concerned with environment like REMA.

Reforestation and so on… **4marks**

C) consequence of climate change:

-drought, heat wave, various disaster like floods, heavy wind , rise of the sea level, melting of glaciers , proliferation of pests, disease like malaria…. **4marks**

Section B

1. a)There is an energy crisis because we can not achieve any machine which 100% efficient so some portion energy is lost in environment **3marks.**

b) Data: mass flow rate m/t=1000kg/sec

power p=E/t then Energy E=weight x distance =1000kg/sx1o N/kg x distance.**2marks**

We may consider the motion of water to be free fall then
$d=(1/2)g.t^2=5m/s^2.(2sec)^2=20m$ **2marks**

The power $p=10^4N/s.20m=2.10^5W$ **2marks**

b) Data : efficiency: e=0.5 work W=1MW height h=40m

e=w/input power **2marks**

input power p=w/0.5=2MW **2marks**

input power p=(m/t).g.h then mass flow rate(m/t)=p/(gh)=$\frac{2x10^6}{400}$ kg/s=$5x10^4$ kg/s. **2marks**

2.a.i)Newton's law of gravitation $\mathbf{F}_g=\frac{G\,M\,m}{r^2}$ **(1mark)**where G= gravitational constant

Mand m masses of interacting bodies

r distance between centers of interacting bodies.**2marks**

ii) Gravitation field strength is the gravitational force experienced on unit mass $g=\frac{F_g}{m}$ **2marks**

iii) $g=\frac{F_g}{m}=\frac{G\,M}{r^2}$ **2marks**

b) Gravitational potential $V=-\frac{GM}{r}=-\frac{6.7X10^{-11}X6.x10^{24}}{6.4x10^6}$=-$6.28x10^7$ J/kg=-63 MJ/Kg **2marks**

c) period T=24h=1 day

Forces acting on the satellite are gravitational force and centripetal force

$F_g=Fc$ then $\frac{G\,M\,m}{r^2}=\frac{m.v^2}{r}$

$\frac{G\,M}{R_0}=\frac{(2\pi\,R_0))^2}{T^2}$ $R_0=\sqrt[3]{\frac{G\,MT^2}{4\pi^2}}$ **3marks**

Energy of the orbit $E=E_p+E_K=\frac{-GM\,m}{r}+\frac{GM\,m}{2r}=\frac{-GMm}{2r}$

The kinetic energy of a launched satellite will be equal to the energy of orbit $E_k=\frac{1mv^2}{2}=\frac{GMm}{2r}$ with r =h height of satellite above the surface of earth h= 36000km. then $E_k=\frac{6.7\,X10^{-11}*6X^{24}X20000}{2X3.6X10^7}$=$1.1x10^{11}$ J. **3marks**

3. Data :p.d u =1000V

Charge $q=10^{-15}C$

Distance d =20mm=$2x10^2$ m

i) Electrical energy E=q u=10^{-15} C x1000V=10^{-12} J **2marks**

ii) Work done =energy gained W=10^{-12} J **2marks**

iii) Electric force F= $\frac{energy}{distance}$=5x10^{-11} N **2marks**

iv) Electric field Strength E=$\frac{F}{q}$=$\frac{5x10^{-11}N}{10^{-15}C}$=5x$10^{4}$ N/C **2 marks**

v) Electric field strength E=$5X10^{4}$ V/m **2marks**

vi) $\frac{V}{m}$=$\left[\frac{work}{chragexdistance}\right]$=$\frac{forcex\ distance}{chargexdistance}$=$\left[\frac{force}{charge}\right]$=$\left[\frac{Force}{curent\ Xtime}\right]$=$\left[\frac{mass\ Xacceleration}{current\ X\ time}\right]$=$\frac{M\ L}{IT^3}$ so V/m is equal to N/**C** **5 marks.**

4. photoelectric effect

Hf= energy of incident radiation

E_k=kinetic energy of emitted photoelectrons

Φ= Work function of metal (A solar cell)

b)i) The frequency of the light f =$\frac{c}{\lambda}$ = $\frac{3X10^{8}m/s}{5X10^{-7}\,m}$ =6X10^{14} Hz.

ii)The energy of a single photon E=hf=6.626X10^{-34} j.sX6X10^{14} Hz=3.9756X10^{-19}J **3marks**

iii) Number of the photon falling on 1mm^2

power received on 1mm^2=1X10-^{2} w/m^2X$10^{-6}$$m^2$=1X$10^{-8}$w **1.5 marks**

number of photon n=$\frac{E\ total}{E\ single\ photon}$ =$\frac{1X10^{-8}}{3.9X10^{-19}}$ =2.5X10^{10} **1.5 marks**

iV)number of photon electron released on plate=2.5x10^{10}*2000=5X10^{13} **1 mark**

charge Q=ne=2000*2.5X10^{10}X1.6X10^{-19}C= 8X10^{-6} c 1**mark**

electric current I=Q/t= 8X10^{-6} C/1sec=8μA. **1marks**

5. We confirm that greenhouse effect is real because there is persistent increases of temperature on the earth and the consequence associated to it like drought, floods, wild fire , heat wave in some countries, diseases like malaria and so on. **15marks**

Section C.

a)Suitable format for recording data **3marks**

Length/cm	Period t/sec	$\sqrt{l}$
20	0.9	4.47
30	1.1	5.48
45	1.35	6.71
50	1.42	7.07
75	1.74	8.66
100	2.01	10

b) **By a**nalysis the graph of T against $\sqrt{l}$ we obtain that T and l are related in this form T=0.2$\sqrt{l}$ **7marks**