2022 - Environmental physics,

01). b) i). Earth's atmosphere has 5 layers.

- Troposhere
- Stratosphere.
- Mesosphere
- Thermosphere.
- exosphere (Space)

ii). Ozone layer give many benifits for human sustainability.

- Ozone layer absorb the unwanted and harmful Sun's UV radiations (from skin Cancer, weaked immune system, etc)
- Protection of marine life do from uv radiation.
- Climate regulation.
- Reduce the damage to air quality.

iii). Oxygen photodissociation : in the stratosphere, high energy contraulted (UV-C) radiation from the Sun dissociates O_2 into O atoms. this O will Combine with another O_2 molecules and Create O_3 (ozone)

$$O_{2(g)} + h\nu \longrightarrow 2O_{(g)}$$

$$O_{(g)} + O_{2(g)} \longrightarrow O_{3(g)}$$

iv) Ozone photo-dissociation $h\nu + O_3 \longrightarrow O_2 + O$

Ozone and O atoms collision dissociation $O + O_3 \longrightarrow 2O_2$.

02) a). i). Continental plates :- Slightly dense, associated with Continental Crust
Oceanic Plates :- less dense, associated with Oceanic Crust.

ii). Convergence plate boundaries - oc-oc → Seafloor spreading, volcano, shallow eq.
con-con → Rift valley, volcano, eq.

divergence plate boundaries - oc-oc → Subduction, volcanos deep eq.
oc-con →
con-con → Deep eq.

Transform plate boundaries - oc-oc
con-con → Yes

iii). Magnetic pattern on the Ocean floor provides important evidence for plate techtonics. This evidence Comes from Studies of paleomagnetism, which is the study of the Earth's magnetic field recorded in rocks. Earth magnetic field is not Constant but has reversed its polarity numerous times throughout geological history. this called as magnetic reversals.

~~magnetic reversal~~ it help to identify magnetic reversals, sea floor spreading or Continental drifting and finaly support the border theory of plate tectonics

b) i). Seismograph are instruments used to measure and record Seismic waves, which is the Vibration Caused by earthquakes, volcano activity, etc.

the Seismograph ~~machine~~ Components are,

1). ~~Sei~~ Seismic Sensor - The Core Component of Seismograph is Seismic Sensor and it is typically pendulum or a mass-spring system

2) Recording Mechanism - Seismograph has a recoding mechanism to Capture the motion detected by the Sensor and store them in paper or digitally.

Operation :- Sensing vertical and horizontal Ground motion, ⟶ translating it into Signals, amplifying and filtering, Recording the data. finally analyzing for future uses.

ii) the primary waves travels faster than Secondary waves. So,

Speed of p wave (velocity) = V_p , Speed of S wave = V_s , time = t, distance = d

$$vt = d$$

$$V_p \times t = d$$

$$V_s \times (t + \Delta t) = d$$

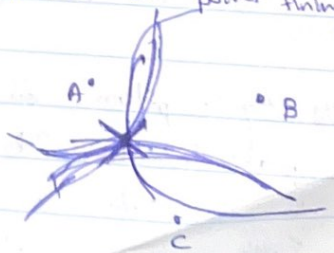
$$V_s \left(\frac{d}{V_p} + \Delta t \right) = d$$

$$\frac{V_s d}{V_p} + V_s \times \Delta t = d$$

$$d\left(1 - V_s/V_p\right) = V_s \times \Delta t$$

$$d = \left(\frac{V_s \times \Delta t}{1 - \frac{V_s}{V_p}} \right)$$

iii) to find epicenter we need atleast 3 Seismograph places then take distances from each of 3 Seismograph places and find the epicenter using Circle method of point finding.



02) c) i). $E = \frac{1}{2} \rho g A L c^2$

$= \frac{1}{2} \times 1000 \times 10 \times 190 \times 10^{-3} \times 1200 \times 10^{-3} \times 5^2$

$= 0.19\ J$

ii) $v = \sqrt{gh}$

$= \sqrt{10 \times 3963}$

$\approx 200\ ms^{-1}$

03 a) Renewble energy Sources :- energy Sources replenish itself at the rate of it is used.

- Solar power, wind power, Geothermic and bio mass energy

Non-Renewble energy Sources :- energy Sources which has limited supply or Can be finish due to using speed is higher than Creating speed.

- Coal, natural gas, Fossil fuel,

b). OTEC - Ocean thermic energy Conversion.

this is a System of electricity Creation using the heat difference of warm surface water and Cold deep ocean water. this is renewble Clean energy and the process release clean fresh water as a byproduct.

c) there are 3 main types of Solar panels Commonly used for harnessing Solar energy ;

1). Monocrystaline Solar panels
2) Polycrystaline Solar panels
3) thin-film Solar panels.

* effiency - (01) 15 - 22 %. (02) 13 - 17 %. (03) 07 - 13%

01 > 02 > 03

* Base panel - (02) from multiple Silicon fragments melted, (01) using Single Crystal Structure of high puarity Crystals. (03) using thin-layer of Semiconductor

Apperance :- (01) uniform black / dark blue Color with grade and uniform look
(02) has a distortive look with spotted or marbled blue color
(03) thin film has flexible and lightweighted design with uniform dark color,

Temperature :- (01) lower
Coefficient (02) slightly higher than (01),
(03) higher

(03) e) Avg. Solar radiation = 200 $W m^{-2}$ day and night.
85% of roof covered with 10% efficency panel.
Need to produce 6000 kwh per day. ? Area of roof.

~~600 kwh is equals to~~,

6000 kwh/day = 6×10^6 wh/day.

Total Solar energy = Avg Solar radiation × Area × efficiency.

6×10^6 wh/day = 200 $W m^{-2}$ × A × $\frac{85}{100}$ × $\frac{10}{100}$

$\frac{6 \times 10^6 \times 100}{85 \times 2} = A$

$A = \frac{30}{85} \times 10^6 \ m^2$

04). a). Sound level - the measurment of the intensity or loudness of a Sound. typically measure ~~using~~ using dB as unit. this is logarithmic scale.

Harmonics - Harmonic are additional frequencies that are integer ~~multiplication~~ multiples of the fundamental frequency of Sound - Harmonics also known as Overtones
fundamental freqy = f, Harmonics - 2f, 3f, 4f....

Q4) 3) 3. Partials :- partials are individual frequency components that make up a complex sound wave. it include both fundamental and harmonics.

4. Octaves :- octaves means two frequencies in which higher frequency has twice the value of lower frequency.

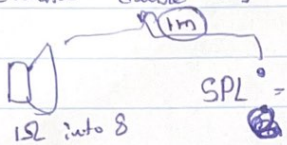
$$\frac{f_H}{f_L} = 2^n \quad ; \quad n = \text{octave band.}$$

b. $f_H = (2^{1/3}) \times 440\ Hz$

$f_H \simeq 562\ Hz$

c. $20 \log(2) = 6\ dB$

distance double → SPL decrease by 2



SPL at 6.1 m ?

$$I_1 = \frac{P}{4\pi (1)^2} \qquad I_2 = \frac{P}{4\pi (6.1)^2}$$

$$\frac{I_1}{I_2} = \left(\frac{6.1}{1}\right)^2$$

$$L_1 = 20 \log_{10}(6.1) = 15.7 \leftarrow L = 20 \log (a_1/a_2)$$

i) $SPL = 115\ dB - 15.7\ dB = 99.3\ dB$

ii) $PWL = 10 \log_{10} (W/W_{ref}) = 10 \log_{10} \left(\frac{0.22}{1}\right) = 6.6\ dB$

$P_2 = 115 - 6.6 = 108.4\ dB$

d) i). $d = 1130\ ft\ s^{-1} \times 0.105\ s = 118.7\ ft$

ii). ~~$SPL = L_w - 20 \log_{10}$~~

$20 \log_{10}(8/1) = 38.5\ dB \quad \therefore \quad 55 = L - 38.5\ dB$

L : SPL direct hyperbola → $L = 93.5\ dB$

Reflection = L' → $L' = 93.5\ dB - 20 \log (118.7/1) = 93.5 - 41.5$

$= 52\ dB$

Q. iii). delay = $\frac{(118.7 - 84)\ ft}{1130\ ft/s}$

= 30.7 ms