

① a) $\lambda_{max} \propto T = 2898 \mu m \cdot K$

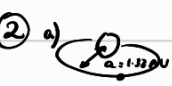
$\lambda_{max} = 72.4 \mu m \therefore T = \frac{2898}{\lambda_{max}} K$
 $= 40 K \checkmark$

b) $\lambda_{max} = 11.36 \mu m \therefore T = 255 K \checkmark$

Not the real temp due clouds & atmosphere $\sim \rightarrow$

Wien's Law \therefore blackbody radiator

planets are not perfect br



orbital period? $\frac{a^3}{T^2} = \text{const} = \frac{a_{earth}^3}{T_{earth}^2} = \frac{1}{1} = 1$
 $T = \sqrt{a^3} = 1.52 y \checkmark$

Surface emits mixture rad \leftarrow temp emissivity reflectivity
 $+$
temp of atmosphere, clouds, internal heat sources

b) i) 6371 000 km

$t = \frac{d}{v} = \frac{6371 \cdot 000 \times 10^3}{c} = 41.25 s$

Here 2 back $\therefore t_{tot} = 2t = 92.5 s \checkmark$

ii) accuracy? radar measuring error $\delta R \approx \frac{c_0}{2B \sqrt{2SNR}}$

③ a) i) Same? no atm \rightarrow no mag

ii) \downarrow magnetosphere Chapman Ferraro distance $10 \text{ cm}^2 \rightarrow 10^3 \text{ km}^3$

(p10, 6a)

b) $R = 360 \text{ km}$

$\rho = 10 \text{ ions/cm}^3$ $B = \sqrt{\frac{R^6}{R_m} \frac{N_0 m_p \rho v_{sw}^2}{2}}$

$v_{sw} = 400 \text{ km/s}$
 $B_{surface} = ? = \sqrt{\frac{(360)^6}{1738} \frac{4\pi \times 10^{-3} \times 16.73 \times 10^{-27} \times 10^8 \times 400 \text{ km}}{2}}$

$mT = 10^{-3}$

$B_{planet} = B_{moon} = 7.26 \times 10^{-8} T \checkmark$ 72 mT

ii) Moon x 10 smaller magnetosphere - makes sense with radius dependence
they are wrong - size is at play?

④ a) $I = \oint \mathbf{B} \cdot d\mathbf{l} = \oint_0^H r^2 dm$ $I = \frac{8}{15} \rho \pi R^5$
 $I = \frac{2}{3} H R^2 \therefore H = \frac{4}{5} \rho \pi R^3$ $??$

- TUTORIAL!

b) $I = \frac{1}{3} H R^2 \therefore R = \sqrt{\frac{3I}{H}}$

$r_2 = 1.5 r_1$ $I = \frac{8\pi}{15} [\rho_1 r_1^5 + \rho_2 (2.71 r_1^5)]$

$\frac{2 \cdot 8}{15} \frac{r}{4}$

$H = \frac{4\pi}{3} [\rho_1 r_1^3 + \rho_2 (2.71 r_1^3)]$

$R = \sqrt{\frac{12}{5} r^2} = \sqrt{\frac{12}{5}} r$

same...

ADD NOTES TO AP!!!

⑤ a) $\Gamma_d = \frac{-\Delta T}{\Delta z} = \frac{g}{c_p}$ \therefore Ratio of heat or lapse rate
 $= \frac{-0.29}{3000} = 9.7 \times 10^{-5} = \frac{g}{c_p}$
 $c_p = \dots$ need to know this to solve it!

6) 2 AU log

