① a) $\lambda_{max} \times T = 2898\ \mu m \cdot k$

$\lambda_{max} = 72.4\ \mu m \quad \therefore T = \frac{2898}{\lambda_{max}}\ k$

$= 40\ k$ ✓

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

Wien's Law ∴ Blackbody radiator = planets are not perfect bc surface emits mixture rad (temp, emissivity, reflectivity) + temp of atmosphere, albedo, internal heat sources

Not the real temp due clouds & atmosphere ~→

② a) 

orbital period? $\frac{a^3}{T^2} = const = \frac{a_{earth}^3}{T_{earth}^2} = \frac{1}{1} = 1$

$T = \sqrt{a^3} = 1.52\ y$ ✓

b) i) 6371 000 km

$t = \frac{d}{v} = \frac{6371\,000 \times 10^3}{c} = 21.25\ s$

there & back ∴ $t_{tot} = 2t = 42.5\ s$ ✓

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

$\updownarrow$ 40 cm

③ a) i) same? no atms → no mags

ii) ↓ magnetosphere Chapman Ferraro distance $10\ cm^3 \rightarrow 10^3\ km^3$ (p10, 6a)

b) $R = 360\ km$

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

$v_{sw} = 400\ km/s$

$B_{surface} = ?$

$= \sqrt{\frac{(360)^6}{1738} \frac{4\pi \times 10^{-7} \times 1673 \times 10^{-27} \times 10^3 \times 400\ km}{2}}$ ×10³ ?

$B_{planet} = B_{moon} \quad = 7.26 \times 10^{-8}\ T$ ✓ 72 nT

mT: 10^{-}

ii) ~~Moon x10 smaller magnetosphere — makes sense with radius dependence~~

they are wrong — size is not at play?

④ a) $I = \int dI = \int_0^M r^2\, dm \qquad I = \frac{8}{15} \rho \pi R^5$

$I = \frac{2}{3} M R^2 \quad \therefore M = \frac{4}{5} \rho \pi R^3$?? 06 — TUTORIAL!

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

$r_2 = 1.3\, r_1$ $\qquad I = \frac{8\pi}{15}\left[\rho_1 r_1^5 + \rho_2 [2.71 r_1^5]\right]$

$M = \frac{4\pi}{3}\left[\rho_1 r_1^3 + \rho_2 (2.71 r^3)\right]$

$R = \sqrt{\frac{12}{5} r^2} = \sqrt{\frac{12}{5}}\, r_1$

$\frac{2}{5} \frac{3}{15} \frac{1}{4}$

$\therefore \frac{I}{M} = \frac{2}{5} r^2$

same...

ADD NOTES TO A4!!!

⑤ a) $\Gamma_d = \frac{-\Delta T}{\Delta z} = \frac{g}{c_p}$: Rate of dust or Lapse rate

$= -\frac{0.29}{3000} = 9.7 \times 10^{-5} = \frac{g}{c_p}$

$\frac{c_p}{g}$ ... u need to know this to solve it!

b) 2 AU log