Solution MT

1.1 $v = \sqrt{gd}$ $\quad \frac{V_B}{V_A} = 2 = \frac{\sqrt{g_2 2}}{\sqrt{g_1 1}} = \sqrt{\frac{2g_2}{g}}$

$\Rightarrow \quad 4 = 2\frac{g_2}{g} \Rightarrow g_2 = 2g.$

1.2 g actually increases since the reduction of ~~mass~~ radius (mass) is offset by increase in density.

$$g = \frac{GM}{r^2} = \frac{G\rho V}{r^2} = G\rho\frac{4}{3}\pi r$$ while r decrease, ρ increases, offsetting g reduction.

1.3 From Red Deer to Leduc, direction is directly Northward. E-W = transverse, which can have SH wave type and Love waves. So 3 phases could be, $S_{(SH)}$, $SS_{(SH)}$ ... + Love

1.4 total arc length = 500 m/s × 3600 × 4 s = 7200000 m = 7200 Km.

$$\text{radius} = \frac{7200\ km}{60 \times 3.1415/180} = 6876\ km.$$

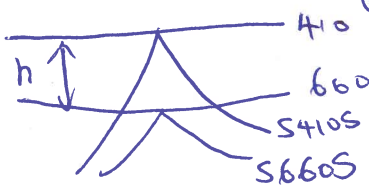
1.5. $$\text{Barycenter} = \frac{0 \cdot M_S + D_{ES} \cdot M_e}{M_S + M_e} \approx \frac{1.5\times10^{8} \cdot M_e}{M_S} = \frac{1.5\times10^{8} M_e}{2\times10^{30}} = 7.5\times10^{-23} M_e$$

1.6. a) The elliptical orbit ≈ circular orbit.

b) $$\text{Force 1} = \frac{GMm}{r^2}$$

$$\text{Force 2} = m\frac{v^2}{r} = mw^2r.$$

Problem 2.



(a) Approximate raypaths are nearly vertical.

$$\Delta t = t_{S660S} - t_{S410S} \approx 2\cdot h/V$$

$$h = \frac{\Delta t \cdot V}{2} = \frac{70 \times 10/\sqrt{3} \times 202}{2} \approx 2020\ km$$

Since $h_{avg} = 250$ km > 202 km ⇒ thin transition zone

(b) thin Tz → hot → Hawaii, Yellowstone, etc.

Problem 3. Need to use $g_n = g_e(1 + \alpha \sin^2\lambda - \beta \sin^2 2\lambda)$

$$= 9.78(1 + 5.3\times10^{-3}\sin^2 52^\circ - 0.58\times10^{-6}\sin^2 104^\circ)$$

$$= 9.812\ m/s = 981200\ mGal.$$

Bouguer corrected $g_B = 981200 + (0.3086 - 0.1119)(700) = 981337.7$ mGal.

(0.1967 × 700 = 137.7)

Problem 4.

(A) S phase since it is on all three components. radial + vertical = SV type and transverse = SH type

(B). Love wave since so small on P-SV plane, and not SH. (C) Rayleigh since after Love and no SH component

$v = 52/1 \cong 4$ km/s $\Rightarrow \lambda = 4 \times 1 = 4$ km