GEOPHYSICS 210 MID-TERM EXAM 2007

SOLUTION

1(a) $g_S = \frac{GM_S}{R^2} = 5.89 \times 10^{-3}\ ms^{-2} = 589$ mgal

(b) $g_M = \frac{GM_M}{R^2} = 3.33 \times 10^{-5}\ ms^{-2} = 3.3$ mgals

note units for R ⇒ km

(c) Tides due to gradient of gravity. Thus since $g \propto 1/r^2$ the gradient is highest for the moon.
Keyword: spatial gradient. Also note $g_S > g_M$

(d) Length of day observations
- ⇒ accurate astronomy
- ⇒ timing of eclipses
- ⇒ coral growth rings (daily)
- ⇒ tidal rhythmites

see notes

(e) See notes. Keywords - tidal friction, slows earth
⇒ conserve angular momentum requires moon to orbit faster
⇒ higher orbit.

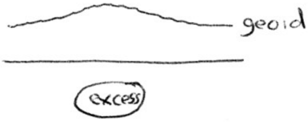
Q2 (a)

Distortion	$g_P > g_E$
mass re-distribution	$g_P < g_E$
rotation	$g_P > g_E$

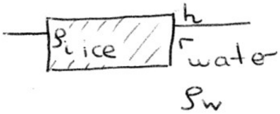
(b) → sea level measured by radar from a satellite
Sea bunches up over an excess mass

→ monitor orbit of satellite. Either track from ground, or with a pair of satellites (GRACE)

(c) Geoid - gravitational, equipotential at mean sea-level



Q3



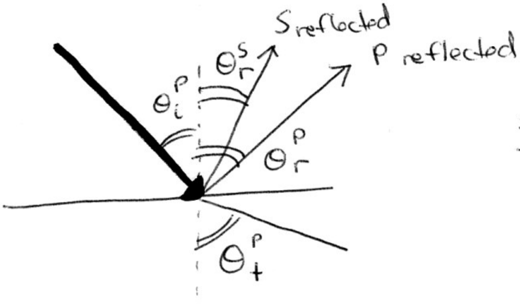
$$r = \frac{\rho_i h}{\rho_w - \rho_i}$$

$$r + h = 400$$

$$h = 42.7 \text{ m}$$

Q4

⇒ no S-wave in outer core. It is liquid (notes)



$$\frac{\sin \theta_i^P}{V_p} = 0.04412$$

P-wave reflected $\quad 0.04412 = \frac{\sin \theta_r^P}{13} \quad \theta_R^P = 35°$

S-wave reflected $\quad 0.04412 = \frac{\sin \theta_R^S}{7} \quad \theta_R^S = 18.0°$

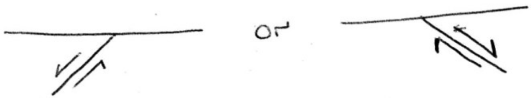
P-wave transmitted $\quad 0.04412 = \frac{\sin \theta_t^P}{8} \quad \theta_t^P = 20.7°$

Q5 (a)

• two possible strike-slip faults

map

normal fault

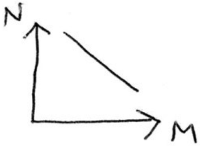


• two possible normal faults

⇒ two possible orientations

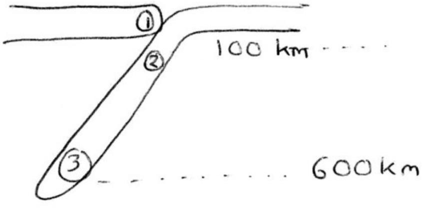
⇒ mixture of strike-slip and normal fault;

(b)



⇒ more small earthquakes than large earthquakes

(c)



① MEGATHRUST

② INTERMEDIATE

③ DEEP