GEOPHYSICS 210 FINAL EXAM 2007

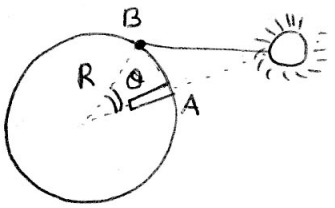
(1a) Slabs imaged as LVZ and cross transition zone in the mid-mantle

(1b) Explosions give more P-waves than S-waves, compared to earthquakes

Compressive first motion in all directions for explosion

(1c) Olivine → Spinel 440 km
Spinel → perovskite 660 km

(1d) San Andreas Fault, North Anatolian Fault

(1e) 

⇒ measure distance A-B = x m
⇒ measure angle of sun (Θ)
⇒ $x = R\Theta$
⇒ $R = \frac{x}{\Theta}$ = radius of Earth

(1f) Curie depth is depth at which magnetic behaviour ceases, since temperature exceeds Curie temperature. Thermal vibration of atoms prevents domain formation

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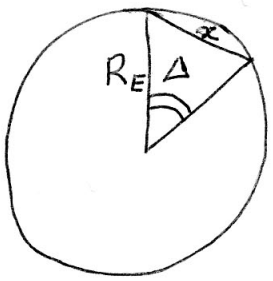
(2a) $$D = \frac{t\rho_i}{\rho_m} = 297 \text{ m}$$

(2b) Airy expected a pendulum to deflect by attraction of Himalaya. Not observed because pull of mountains cancelled by lack of attraction due to low density root.

(3a)



$$\sin\left(\frac{\Delta}{2}\right) = \frac{x}{2R_E}$$

$$x = 2R_E \sin\left(\frac{\Delta}{2}\right)$$

$$\text{time} = \frac{\text{distance}}{v_m} = \frac{2R_E}{v_m}\sin\left(\frac{\Delta}{2}\right)$$

(3b) Ray paths are straight lines for $\Delta = 0° \rightarrow 120°$

(3c) $\Delta = 120°$

(3d) $t = \dfrac{2R_E \sin 60°}{8} = 1300 \text{ secs} = 21.7 \text{ minutes}$

(3e) Travel times are curves. See next page.

(3f) Bounce on core, straight line rays. $\Theta = 0° \rightarrow 120°$

(3g) $\Delta = 120°$

(3h) $\text{time} = \dfrac{\text{distance}}{\text{velocity}} = \dfrac{2 \times 3000}{8} = 750 \text{ seconds}$

(3i) Travel time is a curve. when $\Delta = 0°$ $t = 750$ seconds
At $\Delta = 120°$, the direct and reflected waves have same travel time and take same route in Earth

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(3j) $\text{time} = \dfrac{6000}{8} + \dfrac{6000}{6} = 1750 \text{ seconds}$

(3k) See attached. Note shadow zone with no P-wave arrivals.

(4a) Diamagnetism: in prescence of applied magnetic field, the atom develops a magnetic field that is in opposite direction to the applied field

k is negative;

All minerals diamagnetic, but will be masked by paramagnetism

Paramagnetism: atom has net magnetic moment due to unpaired electron. External field will align the atoms to reinforce the applied magnetic field

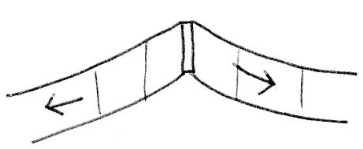
k is positive

Cobalt, nickel, iron

(4b)

Dynamo action in core	98%
Crustal magnetization	1-2%
magnetosphere (external)	1-2%

(4c)

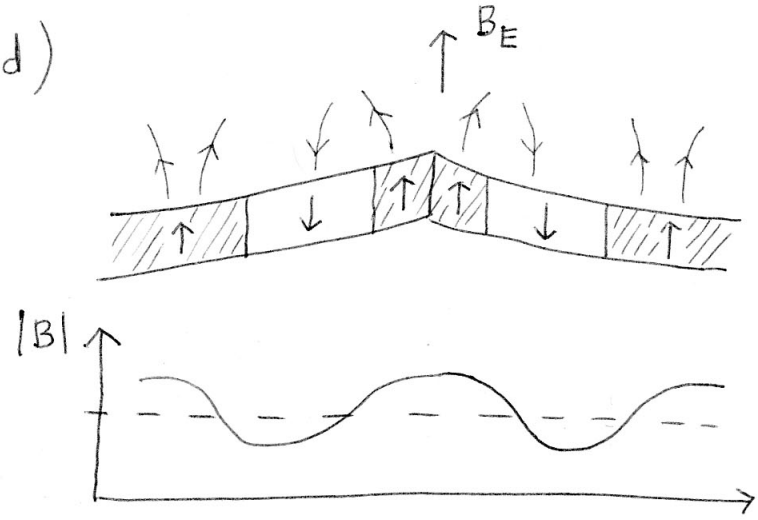


⇒ basalt erupted and when cools it is permanently magnetized in direction of Earth's magnetic field at that time

⇒ seafloor spreading moves these rocks away from ridge

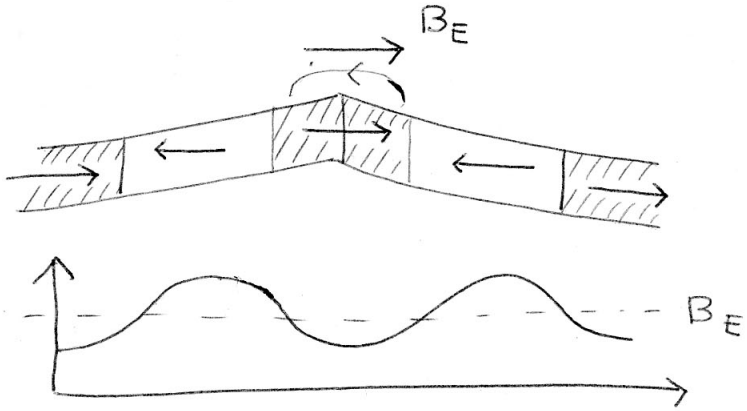
⇒ field reverses direction

(4d)



⇒ high magnetic latitude

⇒ positive anomaly at ridge crest



⇒ low magnetic latitude

⇒ negative anomaly at ridge crest

(5a) maximum value = 2 milligals

$x_{1/2}$ when g_z = 1 milligals

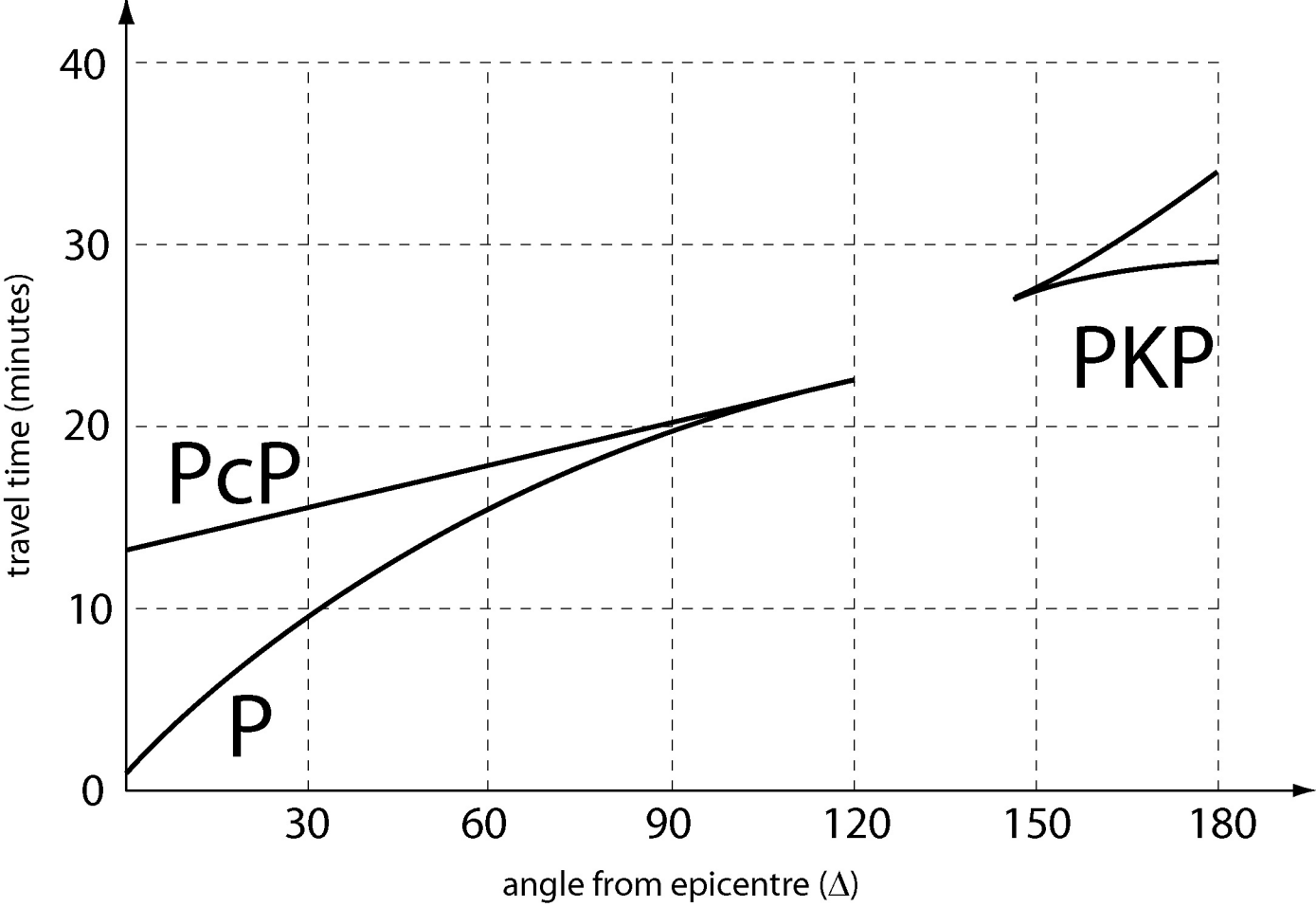
$$x_{1/2} = 100 \text{ m}$$

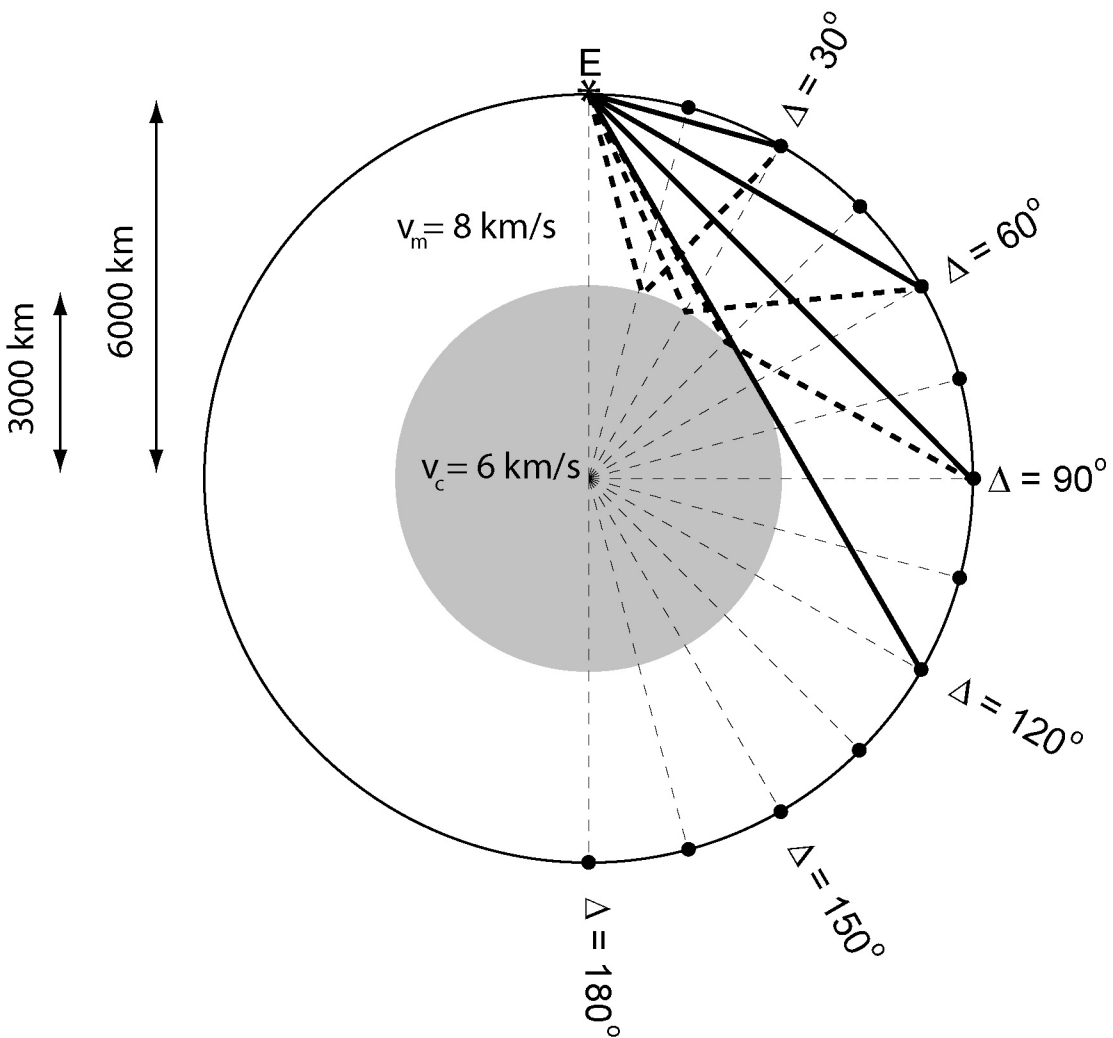
(5b) $x_{1/2} = 0.766\, z \Rightarrow z = 1.3 x_{1/2} = 130 \text{ m}$

(5c) $$M_E = \frac{g^z_{max} z^2}{G} = 5.1 \times 10^9 \text{ kg}$$

(5d) Can't find radius with information given in class. Many combinations of radius and density give same value of M_E

NON-UNIQUE !!


40
30
20
10
0
travel time (minutes)
PcP
P
PKP
30
60
90
120
150
180
angle from epicentre (Δ)


E
Δ = 30°
Δ = 60°
Δ = 90°
Δ = 120°
Δ = 150°
Δ = 180°
v_m = 8 km/s
v_c = 6 km/s
3000 km
6000 km