Interior of the Earth

Standard difficulty · 20 questions · 40 marks · Time: 37 minutes

Name: _____ Date: _____ Score: ____ / 40

Write full answers in Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The earth's radius is about:
(a) 12,756 km **(b)** 400 km **(c)** 2,900 km **(d)** 6,378 km

2. A seismograph is 62° from the epicentre of an earthquake. Which waves will it record?
(a) both P and S-waves **(b)** P-waves only
(c) neither P nor S-waves **(d)** S-waves only

3. What is meant by "lava"?
(a) the weak upper mantle, main source of magma
(b) an instrument that records earthquake waves
(c) the point inside the earth where energy is released
(d) molten rock that has reached the surface

4. What causes tectonic earthquakes?
(a) roofs of underground mines caving in **(b)** the load of large reservoirs
(c) sliding of rocks along a fault plane **(d)** activity in areas of active volcanoes

5. Which describes calderas?
(a) eruptions along a ridge system over 70,000 km long
(b) very fluid lava over vast areas, like the Deccan Traps
(c) viscous lava and ash in layers, explosive
(d) so explosive they collapse into a depression

6. What is a batholith?
(a) a wavy mass at the base of synclines or top of anticlines
(b) a wall-like body nearly perpendicular to the ground
(c) a large granite dome cooled deep in the crust
(d) a saucer shape, concave to the sky

7. The mantle reaches down to about 2,900 km. Suppose the crust is 8 km thick at a place. How thick is the mantle beneath it?
(a) 2,892 km **(b)** 3,470 km **(c)** 2,908 km **(d)** 2,992 km

8. Suppose P-waves travel at 8 km/s and S-waves at 5 km/s. How many seconds after the P-waves do the S-waves reach a station 360 km away?
(a) 27 seconds **(b)** 72 seconds **(c)** 45 seconds **(d)** 117 seconds

Section B — Short answer — 8 × 2 = 16 marks

9. Name two direct sources of information about the interior.

10. Two seismographs are (a) 34° and (b) 113° from an epicentre. Which waves does each record?

11. What is meant by each? (a) magma (b) seismograph

12. What causes each? (a) explosion earthquakes (b) collapse earthquakes

13. Describe each type of volcano: (a) flood basalt provinces (b) mid-ocean ridge volcanoes

14. Describe each intrusive form: (a) sill (b) dyke

15. Suppose P-waves travel at 6 km/s and S-waves at 3 km/s. A station is 720 km from the focus. When does each arrive, and which arrives first?

16. Under a mountain range the continental crust is 45 km thick. (The mean is about 30 km.) How much thicker than the mean is it, and how far is it from its base to the core–mantle boundary at 2,900 km?

Section C — Longer answers — 4 × 4 = 16 marks

17. Explain how earthquake waves help us understand the earth’s interior.

18. Match each with its feature: (a) composite volcanoes (b) shield volcanoes (c) calderas. Choose from: so explosive they collapse into a depression; viscous lava and ash in layers, explosive; fluid basalt, not steep, as in Hawaii.

19. An earthquake is recorded at three stations: (a) 128° (b) 63° and (c) 36° from the epicentre. (i) Which waves reach each station? (ii) Why are S-waves not recorded beyond 105°? (iii) What is the shadow zone?

20. Suppose P-waves travel at 9 km/s and S-waves at 5 km/s. (a) How long does each take to cover 1,485 km? (b) What is the time lag? (c) Which kind of waves is the most destructive, and why?

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Answer key

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Q	Answer	Working
1	**(d) 6,378 km**	—
2	**(a) both P and S-waves**	within 105°: both
3	**(d) molten rock that has reached the surface**	—
4	**(c) sliding of rocks along a fault plane**	—
5	**(d) so explosive they collapse into a depression**	—
6	**(c) a large granite dome cooled deep in the crust**	—
7	**(a) 2,892 km**	2,900 − 8
8	**(a) 27 seconds**	360 ÷ 5 − 360 ÷ 8
9	**Mining and deep drilling (also material from volcanic eruptions).**	—
10	**(a) both P and S-waves (b) neither P nor S-waves**	within 105°: both; 105°–145°: neither; beyond 145°: P only
11	**(a) molten rock material in the upper mantle (b) an instrument that records earthquake waves**	—
12	**(a) explosion of chemical or nuclear devices (b) roofs of underground mines caving in**	—
13	**(a) very fluid lava over vast areas, like the Deccan Traps (b) eruptions along a ridge system over 70,000 km long**	—
14	**(a) a thick, nearly horizontal intrusive body (b) a wall-like body nearly perpendicular to the ground**	—
15	**P after 120 s, S after 240 s; P-waves arrive first (120 s earlier)**	720 ÷ 6; 720 ÷ 3
16	**15 km thicker; 2,855 km**	45 − 30; 2,900 − 45
17	**Waves change speed and direction in materials of different density; S-waves stop at the liquid outer core, creating shadow zones that reveal the layers.**	—
18	**(a) viscous lava and ash in layers, explosive (b) fluid basalt, not steep, as in Hawaii (c) so explosive they collapse into a depression**	—

Q	Answer	Working
19	**(i) (a) neither P nor S-waves (b) both P and S-waves (c) both P and S-waves (ii) S-waves cannot travel through the liquid outer core. (iii) The zone between 105° and 145° where neither wave is recorded.**	within 105°: both; 105°–145°: neither; beyond 145°: P only
20	**(a) P 165 s, S 297 s (b) 132 s (c) surface waves: they arrive last and displace rocks, so structures collapse.**	1,485 ÷ 9; 1,485 ÷ 5; difference