5 **(a)** **(i)** Electromagnetic waves have many uses.

On Fig. 5.1 draw **one** line from each use to the region of the electromagnetic (e-m) spectrum it uses.

Use	Region of e-m spectrum
security marking	gamma rays
Bluetooth	ultraviolet
optical fibres	infrared
detection of cancer	radio waves

Fig. 5.1

[2]

(ii) State **one** advantage of using microwaves compared with radio waves to transmit mobile (cell) phone signals.

.....

..... [1]

(b) Describe the difference between transverse waves and longitudinal waves.

.....

.....

.....

..... [2]

(c) Fig. 5.2 shows a simplified diagram of seismic P-waves travelling through the Earth. The paths of the waves are curved.
Seismic waves are produced by rock movements in earthquakes.

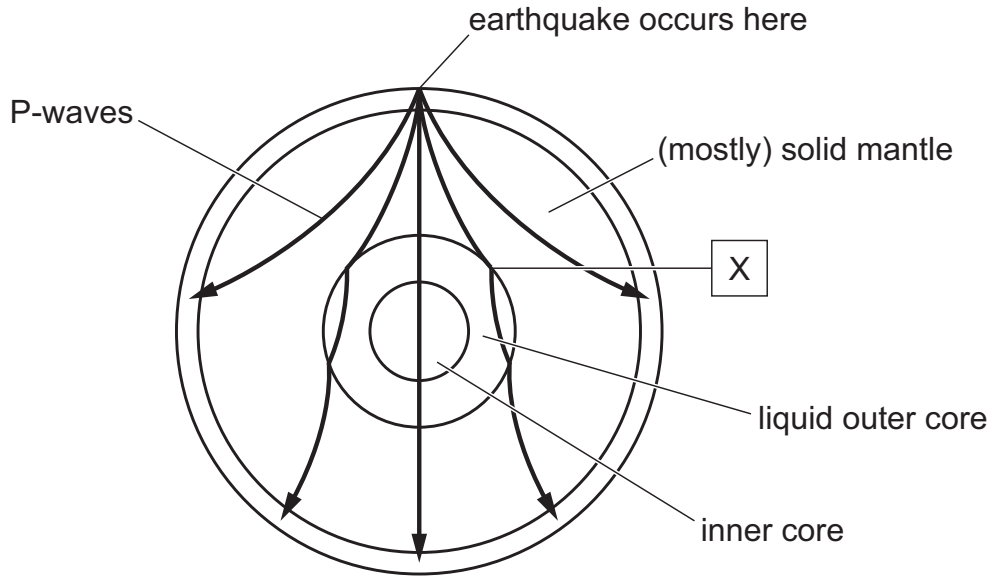

Fig. 5.2 (not to scale)

(i) State the type of wave that P-waves can be modelled as.

..... [1]

(ii) At point X, the P-wave travels from the solid mantle to the liquid core. There is a sudden change in direction of the path of the wave.

Explain the change in direction of the P-wave at point X.

.....

.....

..... [2]

(d) The Earth's surface absorbs incoming radiation from the Sun and also emits thermal radiation from its surface.

Over the past 50 years, scientists estimate that the average temperature of the Earth's surface has increased by approximately 0.75 °C.

Explain what is causing this average temperature rise.

.....

.....

.....

..... [2]

[Total: 10]