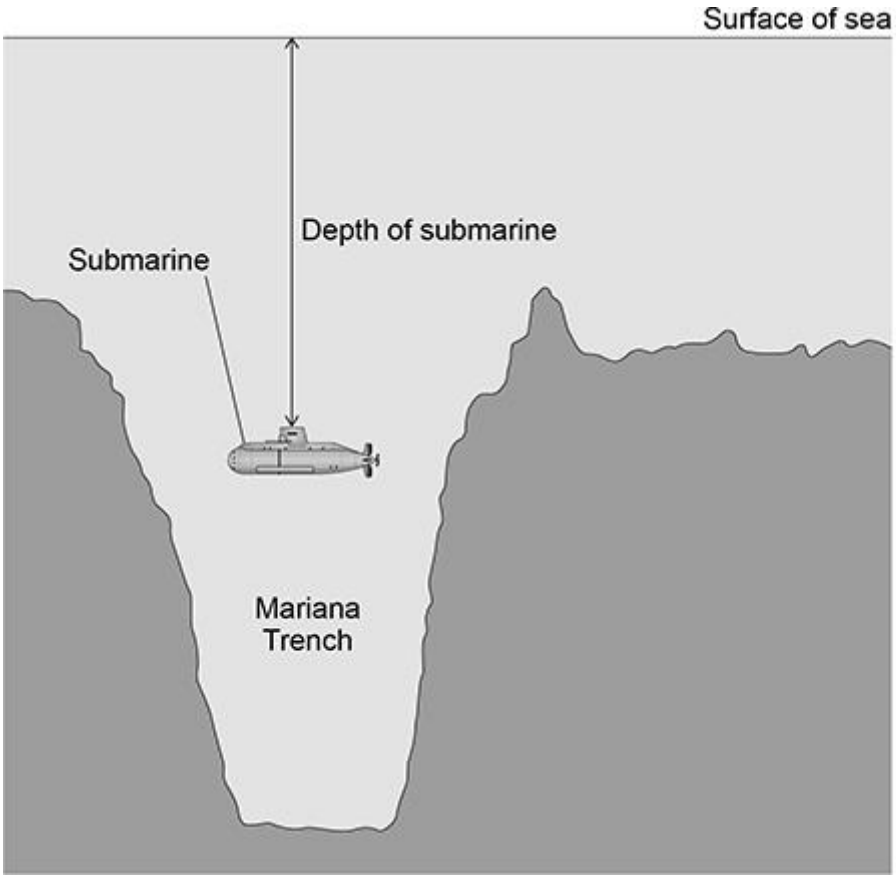
Questions are for separate science students only

Q1.

The Mariana Trench is the deepest part of the Pacific Ocean. **(Physics only)**

Figure 1 shows a submarine going to the bottom of the Mariana Trench.

Figure 1



Not to scale

(a) The depth of the submarine increases.

Explain what happens to the pressure on the submarine.

_____

_____

_____

_____

(2)

(b) The submarine moved from the surface of the water to the bottom of the Mariana Trench.

The change in pressure was 110 000 kPa.

mean density of sea water = 1026 kg/m^3

gravitational field strength = 9.8 N/kg

Calculate the depth of the Mariana Trench.

Use the Physics Equations Sheet. **(HT only)**

Depth = _____ m

(4)

Earthquakes often occur at the Mariana Trench.

P-waves and S-waves are produced by earthquakes.

(c) Which statement describes P-waves and S-waves? **(HT only)**

Tick (✓) **one** box.

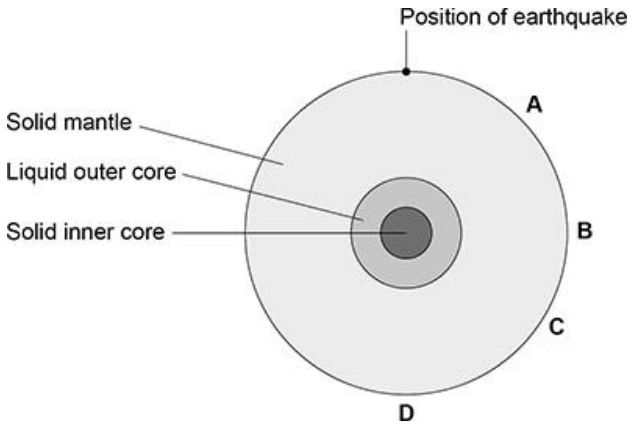
- Both P-waves and S-waves are longitudinal. ☐
- Both P-waves and S-waves are transverse. ☐
- P-waves are longitudinal and S-waves are transverse. ☐
- P-waves are transverse and S-waves are longitudinal. ☐

(1)

(d) **Figure 2** shows the layers inside the Earth.

An earthquake occurs at the position shown.

Figure 2



Which letter shows the position where **only** P-waves will be detected?

Give a reason for your answer.

Tick (✓) **one** box. **(HT only)**

Yes ☐ No ☐

Reason _____

_____

(2)

(e) An S-wave has a frequency of 3.6 Hz.

The S-wave has a speed of 4.5 km/s.

Calculate the wavelength of this S-wave.

Use the Physics Equations Sheet. **(HT only)**

_____

_____

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_____

Wavelength = _____ m

(3)

(f) A seismometer is a device that detects earthquakes.

P-waves travel at a known speed between an earthquake and a seismometer.

S-waves travel at a slower speed than P-waves.

A P-wave and an S-wave from the earthquake arrive at the seismometer at different times.

Describe the relationship between the distance from the earthquake to the seismometer and the time between the P-wave and the S-wave arriving.
(HT only)

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(2)

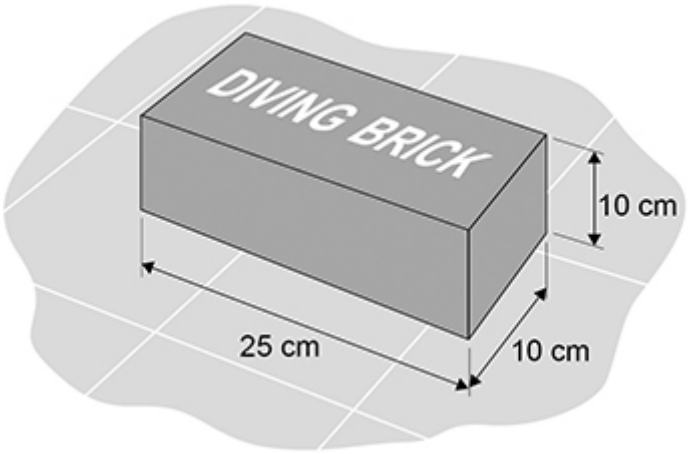
(Total 14 marks)

Q2.

Diving bricks sink to the bottom of a swimming pool. **(Physics only)**

Figure 1 shows a diving brick.

Figure 1



Swimmers practise diving to the bottom of the swimming pool to pick up the diving brick.

(a) Explain why the forces on the brick at the bottom of the pool cause the brick to be stationary.

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_____

(3)

(b) When the brick from **Figure 1** is at the bottom of the pool, the top surface of the brick is 2.50 m below the surface of the water.

The force acting on the top surface of the brick due to the weight of the water is 637 N.

gravitational field strength = 9.8 N/kg

Calculate the density of the water in the swimming pool.

Use the Physics Equations Sheet. **(HT only)**

Density of water = _____ kg/m^3

(6)

(c) Professional divers are trained in a very deep swimming pool.

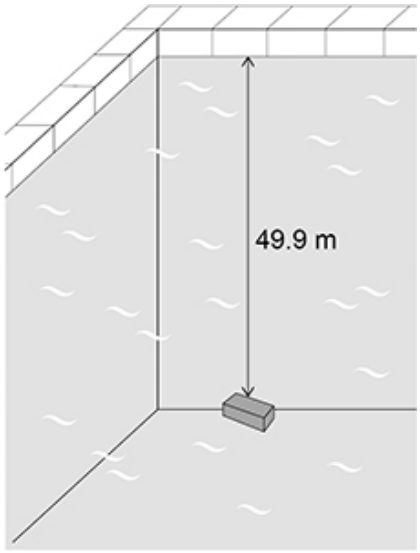
The density of the water in this pool is **not** the same as the density of the water in
part (b).

The diving brick was dropped into the very deep swimming pool.

When the brick was at a depth of 2.50 m, the force due to the weight of the water on the top surface of the brick was 618 N.

Figure 2 shows the diving brick at the bottom of the very deep swimming pool.

Figure 2



Determine the force due to the weight of the water on the top surface of the brick in **Figure 2**.

Use the Physics Equations Sheet.

Give your answer to 3 significant figures. **(HT only)**

_____

_____

_____

_____

_____

Force (3 significant figures) = _____ N

(3)

(Total 12 marks)