Mark schemes

Q1.

(a) the height of the (column of) water above the submarine increases

allow volume / mass for height

1

which increases the force / weight (of the water) acting on the submarine so pressure increases

allow p = ρgh and ρ and g remain constant so pressure increases

1

(b) p = 110 000 000 Pa

1

110 000 000 = 1026 × 9.8 × Δh

allow a correct substitution of an incorrectly / not converted value for p

1

$$\Delta h = \frac{110\,000\,000}{1026 \times 9.8}$$

allow a correct re-arrangement using an incorrectly / not converted value for p

1

Δh = 10 940 (m)

allow a correct calculation from using an incorrectly / not converted value for p

allow 11 000 (m) if correct working shown

1

(c) P-waves are longitudinal and S-waves are transverse

1

(d) D

1

only P-waves can travel through liquids

allow only P-waves can travel through the outer core

allow S waves cannot travel through liquids

allow S waves cannot travel through the outer core

MP2 dependent on MP1

1

(e) $4500 = 3.6 \times \lambda$

allow a correct substitution of an incorrectly / not converted value for v

1

$$\lambda = \frac{4500}{3.6}$$

allow a correct re-arrangement using an incorrectly / not converted value for v

1

$\lambda = 1250$ (m)

allow 1300 (m)

only allow an answer consistent with a correctly converted value for v

1

(f) the distance is (directly) proportional to the time between the two waves arriving (at the seismometer)

allow they are (directly) proportional

*allow a greater distance means a greater time for **1** mark*

*allow there is a positive correlation for **1** mark*

2

[14]

Q2.

(a) upthrust acts (upwards on the brick)

1

normal contact force acts upwards (on the brick)

1

weight is equal to upthrust plus normal contact force

allow resultant force is equal to zero only if all three forces are given

1

(b) $A = 0.25 \times 0.10 = 0.025\ m^2$

1

$$P = \frac{637}{0.025}$$

allow correct substitution of incorrectly calculated value of A

1

$P = 25\,480$ (Pa)

allow correct calculation using an incorrectly calculated value of A

to gain further marks, P = F/A or an incorrect rearrangement of P = F/A must have been used with the given data

1

$25\,480 = \underline{2.5} \times \rho \times 9.8$

allow correct substitution of incorrectly calculated value of P

1

$$\rho = \frac{25\,480}{9.8 \times 2.5}$$

allow correct rearrangement using an incorrectly calculated value of P

allow use of h = 2.6 (m)

1

$\rho = 1040\ kg/m^3$

allow correct calculation using an incorrectly calculated value of P

allow use of h = 2.6 (m)

1

Alternative method

$A = 0.25 \times 0.10 = 0.025$ (m^2)

1

volume of water column
(V) = 0.025 × 2.5

allow use of an incorrectly calculated value of A

1

$V = 0.0625$ (m^3)

allow use of an incorrectly calculated value of A

1

$m \left(= \frac{637}{9.8}\right) = 65$ (kg)

1

$\rho = \frac{65}{0.0625}$

allow use of an incorrectly calculated value of V

1

$\rho = 1040$ (kg/m^3)

1

(c) $F = 618 \times \frac{49.9}{2.5}$

allow calculation of density = 1008.979 (kg/m^3)

1

$F = 12\ 335.28$

1

$F = 12\ 300$ (N)

allow correct rounding of an incorrectly calculated value of F

1

*allow max of **2** marks if 50 m is used*

[12]