| Question Number | Answer | | Mark |
|---|---|---|---|
| 14(a)(i) | • Use of $\rho = \frac{m}{V}$<br>• Use of $A = \pi r^2$<br>• Use of volume in 1 second = cross section area × speed<br>• Speed = 37.1 (m $s^{-1}$)<br><br>Example of calculation<br>$\frac{V}{t} = \frac{300 \text{ kg s}^{-1}}{1030 \text{ kg m}^{-3}} = 0.291 \text{ m}^3\text{s}^{-1}$<br>$A = \pi \times 0.05^2 = 7.85 \times 10^{-3}$ $m^2$<br>Speed = 0.291 $m^3$ $s^{-1}$ / $7.85 \times 10^{-3}$ $m^2$ = 37.1 m $s^{-1}$ | (1)<br>(1)<br>(1)<br>(1) | 4 |
| 14(a)(ii) | • Use of $p = mv$<br>• Rate of change of momentum = $1.1 \times 10^4$ kg m $s^{-2}$ (ecf from (a)(i))<br><br>Example of calculation<br>mass × speed = 300 kg $\times$37.1 m $s^{-1}$ = $1.11 \times 10^4$ kg m $s^{-2}$ | (1)<br>(1) | 2 |
| 14(b) | • Pump applies a (forward) force to the water.<br>• By Newton 3, water applies an (equal and) opposite/backward force to the pump<br>**Or**<br>By Newton 3, water applies a force to the pump in the opposite direction to the (flow of) water. | (1)<br>(1) | 2 |
| 14(c) | • Initially (speed is constant because) drag force = forward force<br>• Turning on pump gives resultant force backwards, so boat slows.<br>• Drag force becomes less (as boat slows) until forces balance again. | (1)<br>(1)<br>(1) | 3 |
| | **Total for question 14** | | **11** |