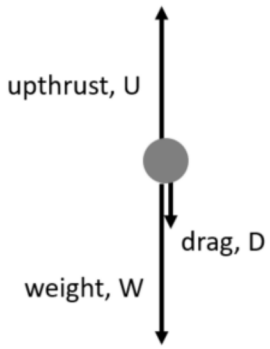
| Question Number | Answer | | Mark |
|---|---|---|---|
| 18(a) | • Weight **Or** $W$, downwards<br>• Drag **Or** $D$, downwards<br><br>  <br> | **(1)**<br>**(1)** | **2** |
| 18(b) | • Use of $V = \frac{4}{3}\pi r^3$<br>• Use of $\rho = \frac{m}{V}$ and $W = mg$<br>• Upthrust = $3.06 \times 10^{-4}$ (N)<br><br>Example of calculation<br>Volume of bead = $4/3 \times \pi \times (2.00 \times 10^{-3}\,\text{m})^3 = 3.35 \times 10^{-8}\,\text{m}^3$<br>Weight of displaced fluid = $930\,\text{kg m}^{-3} \times 3.35 \times 10^{-8}\,\text{m}^3 \times 9.81\,\text{N kg}^{-1}$<br>$= 3.06 \times 10^{-4}$ N | **(1)**<br>**(1)**<br>**(1)** | **3** |
| 18(c)(i) | • The flow must be laminar<br>**Or** There must be no turbulent flow | **(1)** | **1** |
| 18(c)(ii) | • States $D = U - W$<br>• Use of $F = 6\pi\eta rv$<br>• $v = 0.16$ (m s$^{-1}$)<br>• Calculate $v_R = 0.13$ (m s$^{-1}$)<br>• Comparison of $v$ with $v_R$ and correct conclusion (ecf from (b))<br><br>Alternative method of comparison of $F(0.13)$ with $D$ scores full marks.<br><br>Example of calculation<br>$U - W = 3.06 \times 10^{-4} - 1.05 \times 10^{-5} = 2.96 \times 10^{-4}$ N<br>$v = 2.96 \times 10^{-4}\,\text{N} / (6\pi \times 4.9 \times 10^{-2}\,\text{Pa s} \times 2.0 \times 10^{-3}\,\text{m}) = 1.60 \times 10^{-1}\,\text{m s}^{-1}$<br>$v_R = 10 \times 4.9 \times 10^{-2}\,\text{Pa s} / (930\,\text{kg m}^{-3} \times 4.0 \times 10^{-3}\,\text{m}) = 1.32 \times 10^{-1}\,\text{m s}^{-1}$ | **(1)**<br>**(1)**<br>**(1)**<br>**(1)**<br>**(1)** | **5** |
| | **Total for question 18** | | **11** |