Mark Scheme modification Thurs. 22nd Nov 2018

(a) Use of a ly as 10^{16} m is 5% out. Ans. 2.14 m/s ②.

(b) Use of diameter 6cm (rather than radius) to give $\theta = 14.5°$, $\sin\theta = 0.25$
Then $T = 5.07 = 5.1$ N Allow full ③ marks

(c) –

(d) $b = 0.324\ s^2/m$
$a = 5.4\ s$
} No unit penalty for mixing units. Not in the final answer. Full marks for the answer (with some working).

(e) May mistakenly write m not km. Ok if the time is correct for "that part" a ship of the year.

(f) See added ZMF solution – overleaf.

(g) –

(h) –

(i) Need the internal resistances included.

(j) –

(k) $M_P/M_E = 1/3$ ✓ a mark
No marks for use of $V = \frac{GM}{R}$.

(l) If they forget to "add back in" the oil at the end of the calculation, they get 2/3 as a result. Mark of ③ marks.

Alternative solution Equating pressures at the bottom of the wood block

$P_{bottom} = \frac{2}{3}\rho g \cdot 4b = \frac{2}{3}\rho g b + d\rho g$ ✓

bottom of block = pressure of oil layer + pressure of water level ✓

Hence $\frac{8}{3}\rho g b - \frac{2}{3}\rho g b = d\rho g$

$\frac{6}{3}b = d$

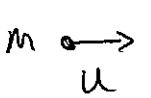
$d = 2b$ ✓

So $b + d = 3b$ submerged. 75% ✓ ④

(m) If they miss the 4.0 m in the expansivity, 270 N
Mark of ③ marks.

Qu 5. overleaf.

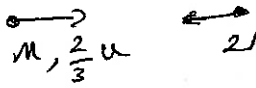
(f) (i) Zero Momentum frame



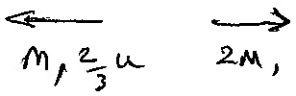
Total mom = mu

velocity of CM is $\frac{mu}{3m} = \frac{u}{3}$ ✓

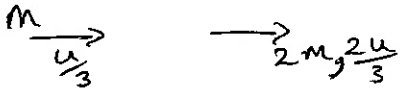
∴ in ZMF



elastic collision so particles go back at the same speed. ✓



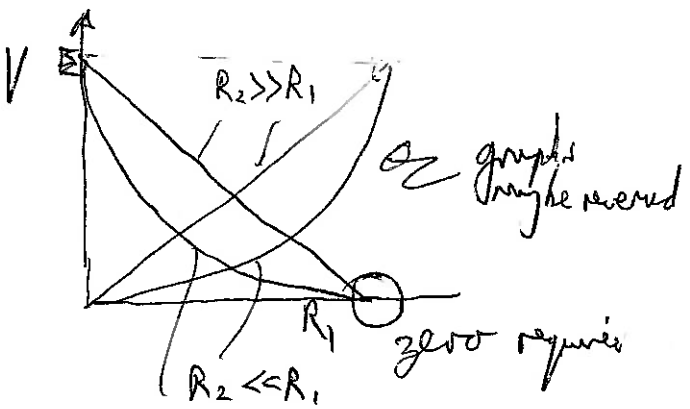
Back in the lab frame (add $\rightarrow u/3$).

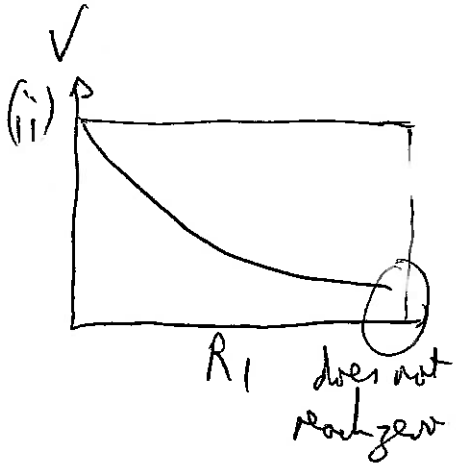


ratio of $\frac{V_d}{u} = \frac{2u}{3}/u = \frac{2}{3}$. ✓

(ii) As on main sheet

Qu 5





a, e $I_1 = 4$ mA
b, d $I_2 = 6$ mA
c $I_3 = -2$ mA.

} may have different signs.