2 (a) A prototype space shuttle attached to a rocket stands vertically on its launching pad. The total mass of the spaceship and rocket (inclusive of the mass of a man in it and its fuel) is 8.5×10^4 kg. On ignition, gas is ejected from the rocket at a speed of 6.0×10^3 m s^{-1} relative to the rocket, and the fuel is consumed at a constant rate of 138 kg s^{-1}.

Calculate

(i) the thrust on the rocket.

thrust = ……………………….. N [1]

(ii) the initial weight of the rocket.

weight = ……………………….. N [1]

(iii) the time it takes for the fuel to burn before the rocket leaves the launching pad.

time = ……………………….. s [2]

(iv) the acceleration of the rocket after the fuel is consumed for 200 s.

acceleration = ……………………….. m s^{-2} [2]

(b) Body A of mass 2.0 kg moves towards Body B of 3.0 kg as illustrated in Fig. 2.1.

Fig. 2.1

(i) Explain why it is not possible for both bodies to stop at the same instant.

....

.... [1]

(ii) Fig. 2.2 is a velocity-time sketch graph showing how the velocity of each body varies. The interaction between the bodies is elastic.

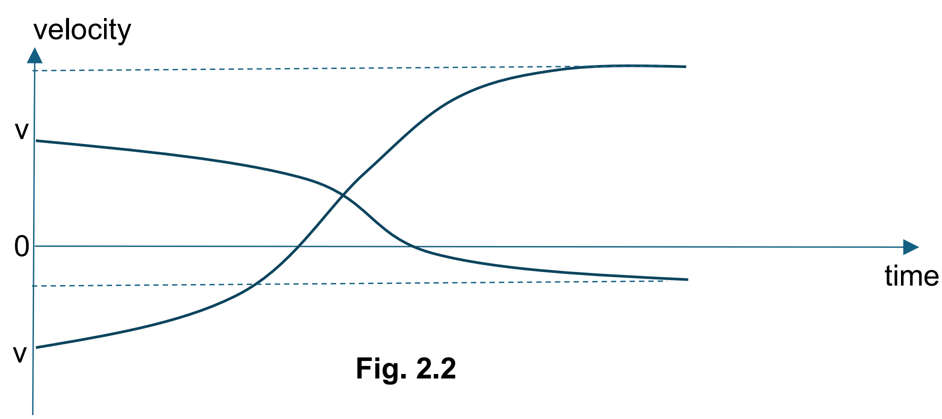

Fig. 2.2

Label the graph to show

1. which curve is for body A, [1]

2. the times at which each body stops, [1]

3. the time at which they are at their distance of closest approach. [1]

[Total: 10]