B2. This question is in **two** parts. **Part 1** is about momentum and **Part 2** is about thermal physics.

  Part 1   Momentum

  (a)   State the law of conservation of linear momentum.   *[2]*

. . . .

. . . .

. . . .
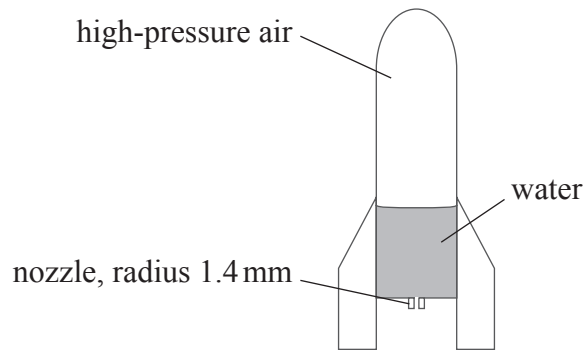
(This question continues on the following page)

(Question B2, part 1 continued)

(b)   A toy rocket of mass 0.12 kg contains 0.59 kg of water as shown in the diagram below.

The space above the water contains high-pressure air. The nozzle of the rocket has a circular cross-section of radius 1.4 mm. When the nozzle is opened, water emerges from the nozzle at a **constant speed** of 18 m s^{-1}. The density of water is 1000 kg m^{-3}.

(i)   Deduce that the volume of water ejected per second through the nozzle is 1.1×10^{-4} m^3. *[2]*

. . . .

. . . .

. . . .

(ii)   Deduce that the upward force that the ejected water exerts on the rocket is approximately 2.0 N. Explain your working by reference to Newton's laws of motion. *[4]*

. . . .

. . . .

. . . .

. . . .

. . . .

(iii)   State why the rocket does not lift off at the instant that the nozzle is opened. *[1]*

. . . .

. . . .

(This question continues on the following page)