2 **(a)** State Newton's third law of motion.

.....

.....

.....

..... [2]

(b) A student stands in an elevator that is initially stationary, as shown in Fig. 2.1.

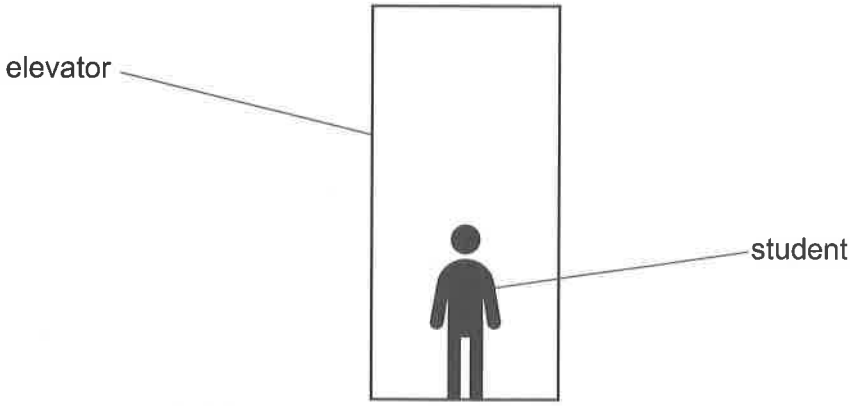

Fig. 2.1

At time $t = 0$, the elevator starts to move with a downward acceleration.

Two forces act on the student: weight of magnitude W and normal contact force of magnitude N.

Complete Table 2.1 to show the properties of the forces that form the Newton's third law pairs with the weight and with the normal contact force.

Table 2.1

	direction	magnitude	body on which the force acts
Newton's third law pair with weight			
Newton's third law pair with normal contact force			

[3]

(c) The mass of the student in **(b)** is 65 kg. The magnitude of the downward acceleration of the elevator is $1.5\,m\,s^{-2}$.

(i) Calculate N.

N = ... N [2]

(ii) The displacement of the elevator is zero at time $t = 0$.

At $t = 2.0$ s, the elevator stops accelerating and travels at a constant velocity for 5.0 s.

(A) Show that the displacement of the elevator is 3.0 m at $t = 2.0$ s.

[1]

(B) On Fig. 2.2, sketch the variation of the displacement of the elevator with t between $t = 0$ and $t = 7.0\,s$.

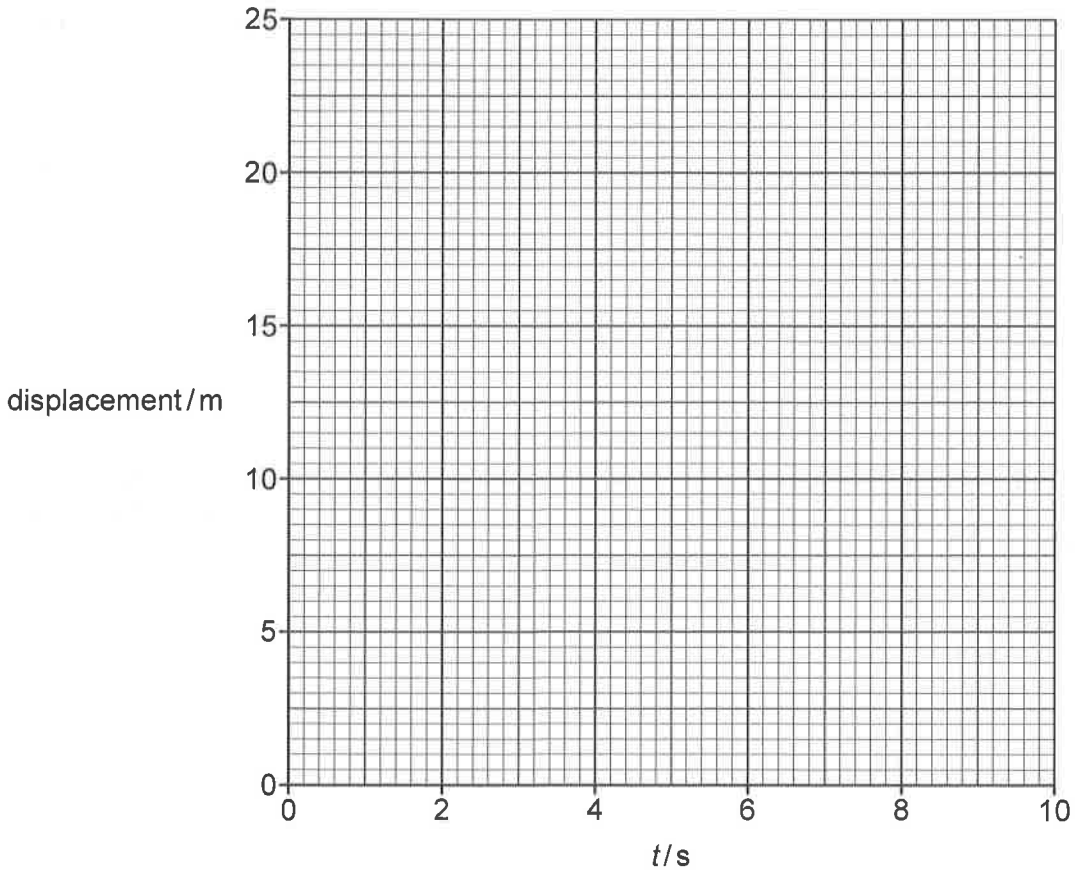

Fig. 2.2

[3]

(iii) At $t = 7.0\,s$, the elevator starts decelerating uniformly to rest.

Between $t = 0$ and coming to rest, the elevator travels a total distance of 20 m.

On Fig. 2.2, continue the sketch of the variation of displacement with t until the elevator comes to rest.

[2]