2 **(a)** Define Newton's second law.

.....

.....

.....[1]

(b) A light rope is attached to a 120 kg box on the ground. The other end of the rope runs over a light frictionless pulley.

A 80 kg man climbs up the free-hanging rope. As the man climbs up the rope, he pulls on the rope hard enough to cause himself to accelerate upwards. The only point of contact between the rope and the man occurs at his hands.

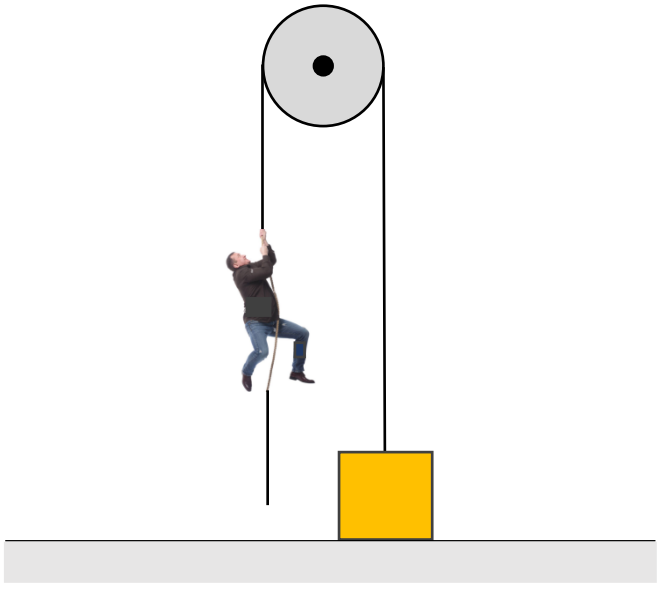

Fig. 2.1

(i) Draw, on the outline of the man in Fig. 2.2, the forces acting on the man as he climbs.

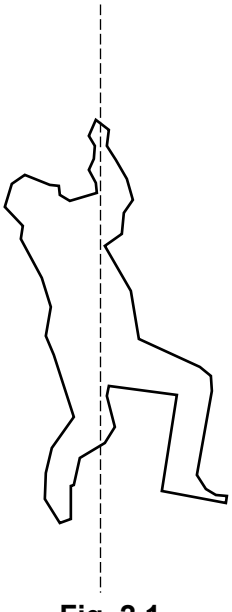

Fig. 2.1

[1]

(ii) If the man climbs the rope with an acceleration of 8.0 m s^{-2}, determine the acceleration of the box.

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

(c) The man releases the rope and the box falls. The box hits the ground with a speed of 2.0 m s^{-1} and sinks into the ground over a vertical distance of 10 cm before coming to a stop.

Calculate the force exerted by the ground on the box during the deceleration.

force = ... N [3]

[Total: 7]