3 Fig. 3.1 shows a lift which travels up and down a cliff. The two carriages are linked by a cable which passes over a pulley at the top of the cliff. The carriages move on tracks. Carriage A on the left is moving down the cliff and carriage B on the right is moving up the cliff. The carriages move at constant velocity up and down the tracks.

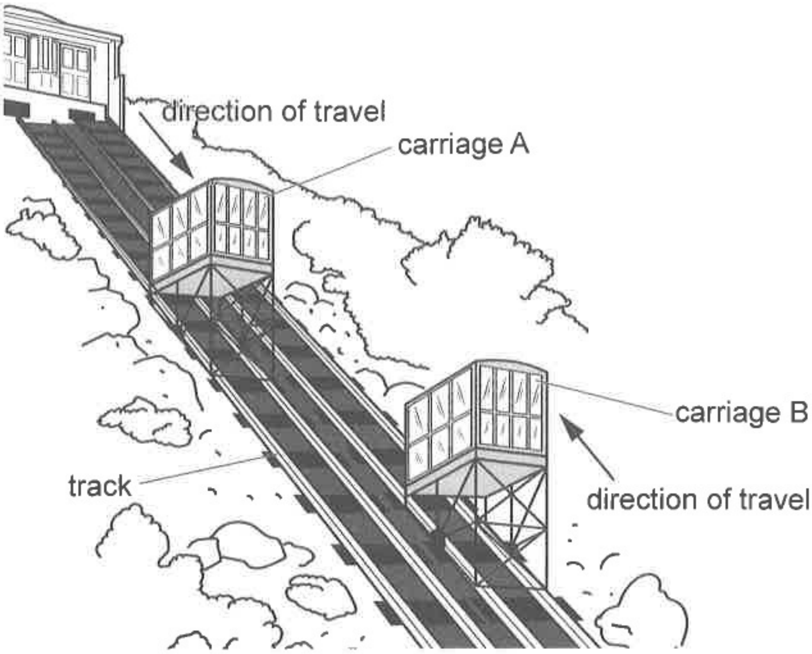

Fig. 3.1

(a) Describe the changes in gravitational potential energy of the carriages as the lift operates.

....

....

.... [1]

(b) The cable is driven by a motor of efficiency 60%. Carriage B travels from the bottom of the track to the top of the track in a time of 1.0 minute. The length of the cable is such that when carriage B reaches the top carriage A is at the bottom. When empty, the carriages have a mass of 800 kg each. The angle of the cliff is 65° to the horizontal and the track is 30 m long. This is shown in Fig. 3.2.

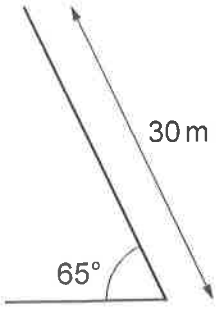

Fig. 3.2

(i) The total mass of the passengers in carriage B is 600 kg.

Calculate the energy gained by carriage B and its passengers when it travels from the bottom of the track to the top.

energy gained = ... J [3]

(ii) Carriage A is empty. Carriage B travels from the bottom of the track to the top.

Calculate the ratio $\dfrac{\text{loss of energy of carriage A}}{\text{gain in energy of carriage B}}$

ratio = ... [2]

(iii) Calculate the minimum input power to the motor.

power of motor = ... W [3]

[Total: 9]