3 **(a)** A pendulum bob is fixed onto the ceiling of a toy train by a string. The train is accelerated to the right with an acceleration a of 2.5 m s^{-2}, as shown in Fig. 3.1. The string makes an angle θ with the vertical.

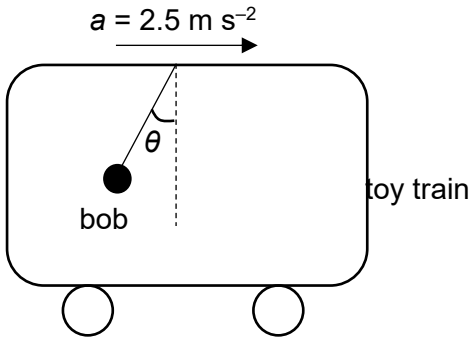

Fig. 3.1

Determine the angle θ.

θ = …… ° [2]

(b) Another train has a helium balloon attached to the floor of the train by a string as shown in Fig 3.2.

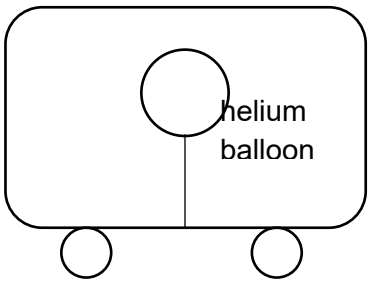

Fig. 3.2

The toy train is then accelerated to the right.
Sketch in Fig. 3.3 and explain the resultant position of the helium balloon when the toy train is accelerating to the right.

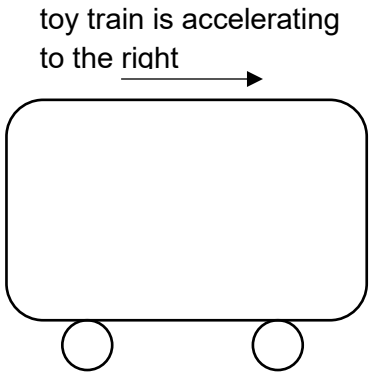

Fig. 3.3

……..……..
...

……..……..
...

……..…….
.[3]

(c) Sand falls vertically on to a horizontal conveyor belt at a rate of 60 kg s^{-1} as shown in Fig. 3.4.

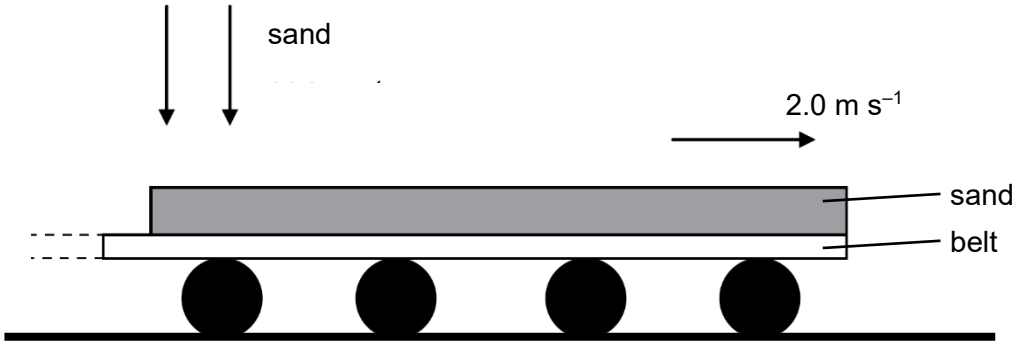

Fig. 3.4

The conveyor belt that is driven by an engine, moves with speed of 2.0 m s^{-1}.

The sand hits the conveyor belt with zero horizontal speed.

(i) Name the type of the force *F* that accelerates the sand to the speed of the conveyor belt.

…….[1]

(ii) Determine the magnitude of the force *F*.

F = …… N [2]

(iii) Calculate the power *P* required to move the conveyor belt at the constant speed.

P = …… W [1]

(iv) Determine the rate of change of kinetic energy *K* of the sand.

K = …… W [1]

(v) Explain why the values of *P* and *K* are not equal.

……..……
…..

……
…….[1]