Higher Forces at Angles Answers

1. $v = 5.6ms^{-1}$.

2. $F_{FR} = 4.01N$.

3. a) $W = mg \sin\theta$.

b) $W = mg \cos\theta$.

4. a) $F = 7.8N$.

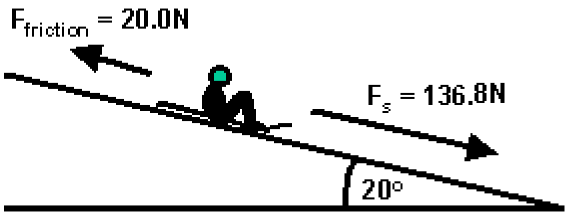
b) $a = 3ms^{-2}$.

5. $F_{FR} = 9.8N$.

6. $F_{FR} = 202.9N$.

7. a) i) $F = 136.8N$

ii) $a = 2.86ms^{-2}$.



b) The component of weight and frictional force are the same at all points on the slope.

This gives a **constant unbalanced force** and therefore a **constant acceleration**.

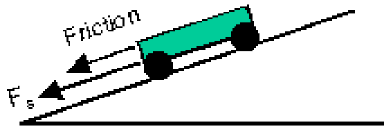
c) The **frictional forces increase** as the **speed** of the sledge **increases**.

Eventually the **frictional force** will be **equal** to the **component of weight** down the slope.

There will then be **zero unbalanced force** and the sledge will move at a constant speed in a straight line.

8. a) i) W = 6.7N.

ii)

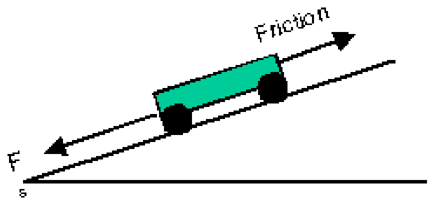


iii) a = – 4ms^{-2}. (**Use F = ma**)

iv) t = 0.75s.

v) s = 1.13m.

b) i)



ii) The unbalanced force accelerating the trolley down the slope is smaller.

This is due to the force of friction acting in the opposite direction to the component of weight.

9. F_{FR} = 170N.

10. a) W = 5.3 x 10^{3}N.

b) a = 1.5ms^{-2}.

c) E_K = 3.25 x 10^{5}J.

11. a) F_H = 66.2N.

b) F_v = 35.2N.

c) E_w = 530J.

12. E_w = 766J.

13. F_H = 8.1N.

14. a) F_H = 7.5N.

b) F_v = 13N.

15. a) F_H = 4.04x10^{6}N.

b) a = 0.05ms^{-2}.

c) F_{FR} = 4.04x10^{6}N in the opposite direction to a).

16. F_{FR} = 671N to the left.

17. a) i) F_v = 4.2 x 10^{3}N.

ii) a = 26ms^{-2}.

iii) The force exerted by the cord decreases with height and the tension decreases.

b) Both the occupants and the seats/capsules are accelerating towards the ground at 9.8ms^{-2}.

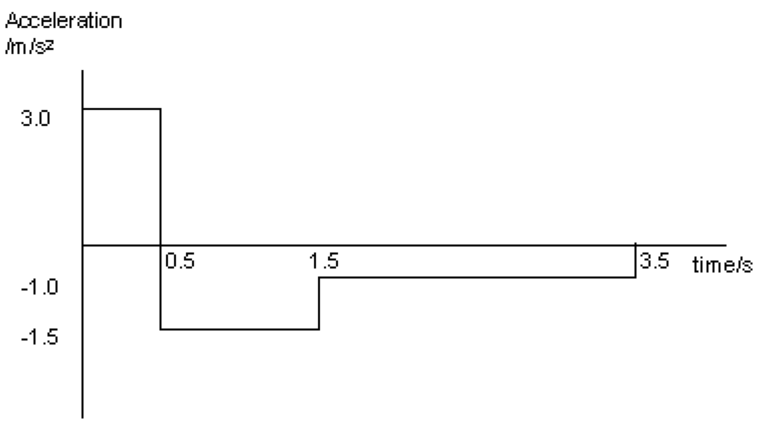
18. a) Maximum displacement at 1.5s.

The trolley is moving away from the sensor for the first 1.5s and then moves back towards the sensor from 1.5 s to 3.5s. (Max area under the graph at 1.5s)

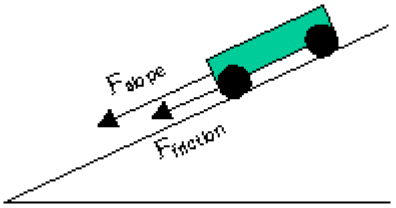
b) OA = 3ms^{-2}.

AB = - 1.5ms^{-2}.

BC = - 1ms^{-2}.



c)



d) When moving up the slope => $F_{unbalanced} = F_{slope} + F_{friction}$

When moving down the slope => $F_{unbalanced} = F_{slope} - F_{friction}$

19. a) W = 220N.

b) a = 0.67ms^{-2}. (Using **a = F/m**)

c) v = 8.2ms^{-1}.

d) Mass is smaller.

Smaller component of weight.

Smaller unbalanced force.

Smaller acceleration.

Smaller speed at the bottom of the slope.

20. F_R = 890N @ 183°.