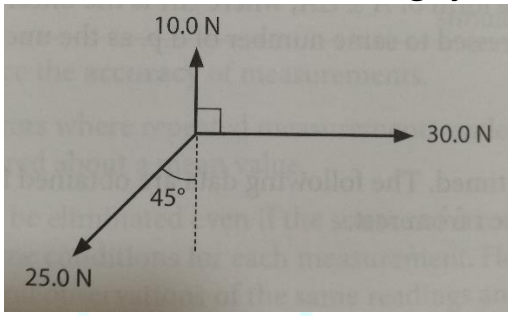
1. The fall of a small metal sphere is timed. The following data are obtained for the time t taken for the sphere to fall a vertical distance s from rest.
   s = 133 , t = 0.520
   Using these data, determine the acceleration of free fall, g , to three significant figures

2. What is the magnitude of the resultant of the following system of coplanar forces?



3. A boat changes its velocity from $8ms^{-1}$ due north to $6ms^{-1}$ due west in a time of 2s. What is its average acceleration?

4. A toy car travelling at 5 ms^{-1} to the left experiences a constant acceleration of 5 ms^{-1} to the right
   a. What is the total distance travelled by the toy car after 4s?

b. Hence find the average speed of the car over 4s

5. John throws a ball vertically upwards at a velocity of 20.0ms^{-1} from a height of 1.20m, where his hands are. Air resistance can be considered negligible
   a. Calculate the highest point from the floor that John's ball will reach

   b. Calculate the velocity of the ball just before it touches the floor

   c. Calculate the time taken for the ball to drop to the floor from the time John throws the ball up

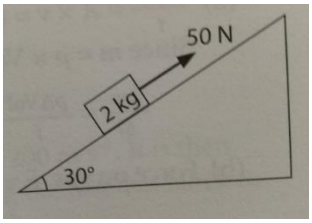
6. In a military exercise, a missile is fired from a tank at speed of 50 ms^{-1} at an angle of 30° above the horizontal. Ignore air resistance
   a. How high should a fighter jet fly in order to be safe from the missile?

b. How much time does it take for the missile to
    i. Reach its greatest height

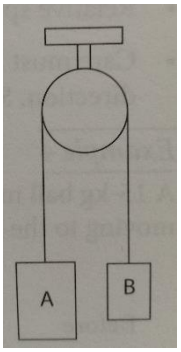
    ii. To reach the ground

c. How far should an enemy tank stay away in order to be out of the range of the missle?

7. A block of mass 2 kg rests on a smooth inclined plane as shown. Given that a constant force of 50N is exerted in the object. Calculate the velocity of the block after it has travelled 5m up the incline.

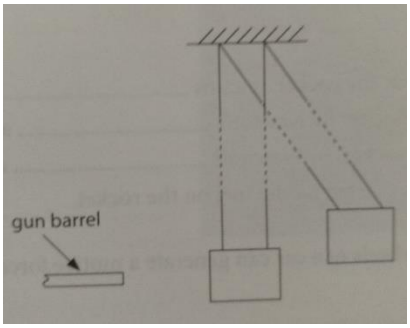


8. Two loads, A and B, of mass 7kg and 3kg respectively are attached to the ends of a light inextensible string that passes over a smooth pulley. The system is released from rest. Calculate the tension T in the string

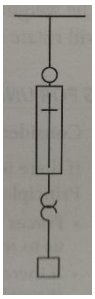


9. A 15kg ball moving to the right at $10ms^{-1}$ makes an elastic head-on collision with a 10kg ball moving to the left at $20ms^{-1}$. Find the velocity of each ball after collision.

10. A bullet of mass 20g is fired from a gun barrel with a horizontal velocity of $200ms^{-1}$. It is then embedded into a suspended stationary wooden block of mass 380g, causing the wooden block to swing upwards. Determine the maximum vertical height gained by the block



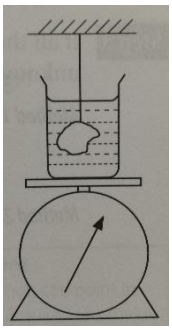
11. A 1.0kg mass is attached to a spring balance of spring constant 100 Nm^{-1}. The mass with spring balance is then hung inside an elevator. Find the extension of the spring when



    a. The lift is stationary

    b. The lift is accelerating upwards at $1ms^{-2}$

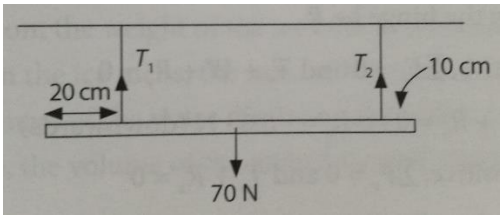
12. A beaker of water of weight, W_o rests on a balance. A mass of weight W_m in air is suspended from a light inextensible string and immersed into the water. When the mass is totally immersed in the position as shown, the upthrust acting on the mass is U. Find, in terms of W_o, W_m and U



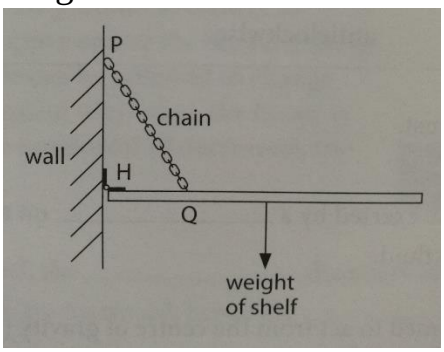
    a. The tension in the string

    b. The reading on the balance

13. A uniform meter rule of weight 70N is supported by two threads of equal length at the 20cm mark and the 90cm mark. Calculate the tensions in the threads as shown.



14. A uniform 1.0m long hinged shelf of weight 10N is held horizontally against a wall by a chain PQ as shown. A hinge H secures the shelf to the wall. Point Q is 0.30m from point H and chain PQ is at an angle of 30° to the wall

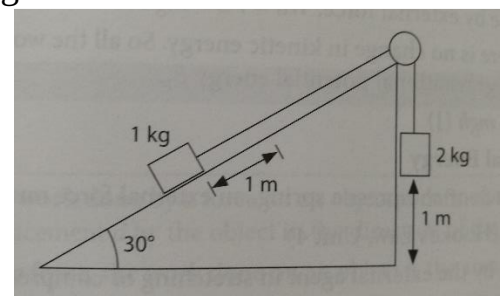


a. Draw the free-body diagram for the shelf

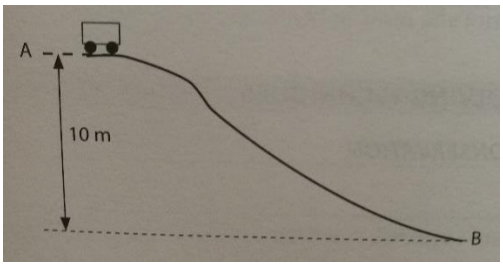
b. Determine the tension in the chain

c. Hence, or otherwise, determine the reaction force acting on the shelf by the image

15. A 1.0kg mass is held on a frictionless plane of 30°. A long inextensible string is tied to the 1.0kg mass and a 2.0kg mass over a frictionless pully as shown. The system is allowed to move from rest. Find the speed of the 1.0kg mass after it has moved 1m.



16. In the diagram shown, a roller-coaster car of mass 10kg is moving past point A at a speed of $5ms^{-1}$. The length of the track from A to B is 20m.



a. Calculate its speed at point B, neglecting friction force

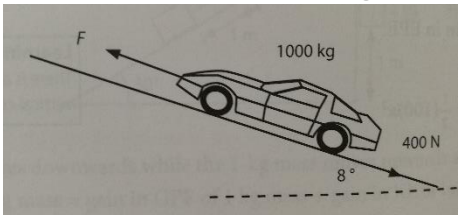
b. If instead a constant friction of 5N acts on the car when it is travelling from A to B, calculate the speed of the car at point B

17. A 1.0kg ball is dropped from rest onto a vertical spring with a spring constant of $100Nm^{-1}$. The ball is released from a height of 2.0m above the spring.

a. Find the maximum compression of the spring

b. Find the instantaneous velocity of the ball when its acceleration is zero

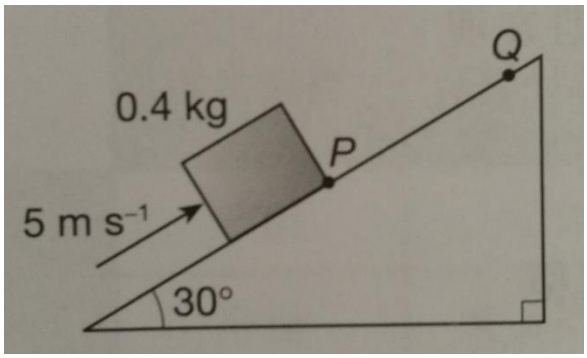
18. A car of mass 1000kg starts from rest and accelerates uniformly to $10ms^{-1}$ in 10s. It experiences a constant resistive force of 400N during this time.



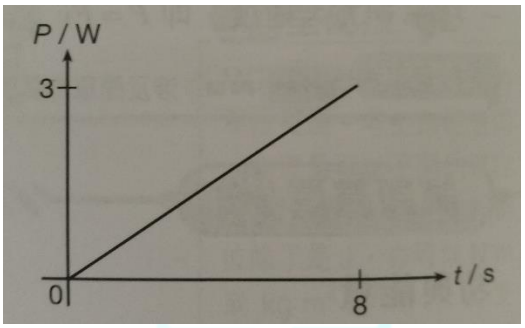
a. Determine the average power developed by the engine during the first 10 seconds

b. Determine the subsequent power output of the engine if the car travels at a constant speed of $10ms^{-1}$

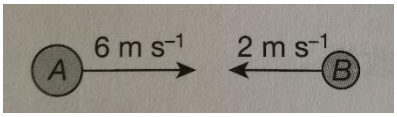
c. The car now climbs a slope at an angle of 8° to the horizontal. Assuming that the resistive force stays constant at 400N, what engine power is now needed to keep the car moving at $10ms^{-1}$?

1. 

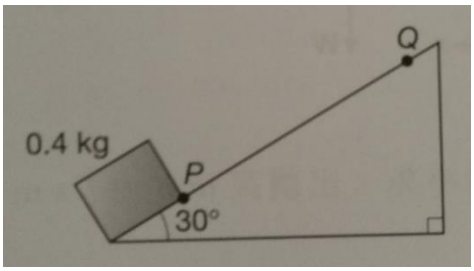
上图所示，以速率 5ms^{-1} 把 0.4kg 方块由 P 点向斜面向上弹射，斜面和方块见的摩檫力为 2.4N。方块到达最高点为 Q。求 P 和 Q 之间的距离

2. 

一个 0.8kg 的方块沿光滑斜面被转变中的力 F 往上推。图中显示 F 提供的功率 P 随时间的变化。与此同时，方块上升了 1.2m 的竖直距离
   a. 求 F 所作的功
   b. 若方块的初始速率为 0.6ms^{-1},则方块于 t=8s 的速率会是多少？

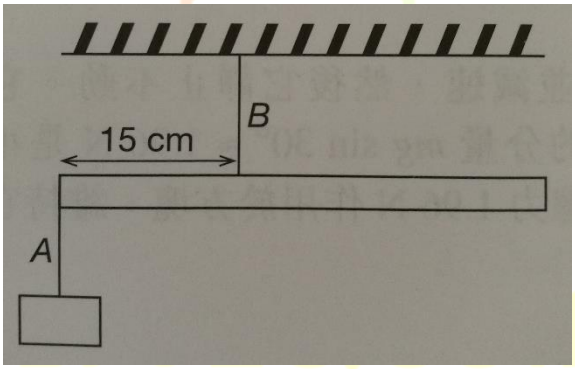
3. 

球 A 和球 B 的质量分别为 3kg 和 2kg，它们如上图所示正向对撞。显示球 A 和球 B 可以分别以速度 2ms^{-1} 和 4ms^{-1} 向右一定

4. 

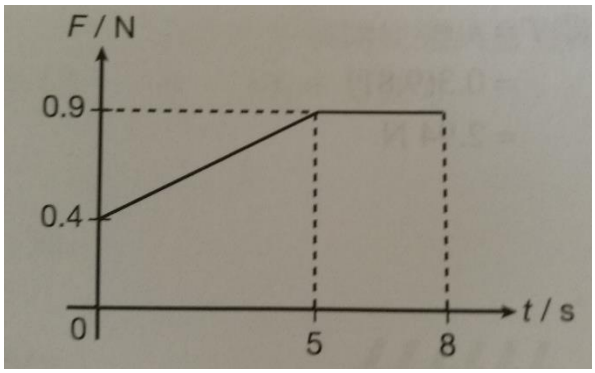
如图所示，把 0.4kg 的方块以速率 5 ms^{-1} 从 P 点沿斜面向上弹射。平面于方块之间的摩檫力是 2.4N。方块到达的最高点是 Q，描述和解释方块随后的运动。

5. 1.2kg 的小球以轻绳挂在天花，小球往旁挪开使绳于竖直成角度 30°，然后把小球从静止释放，当小球被释放的一刻，求绳中的张力



6. 上图，一质量为 0.3kg、长度为 0.5m 的匀棒挂在天花板下。它以左方的方块保持平衡，求绳 B 中的张力 T_B

7. 小球以速率 4 ms^{-1} 由 6m 高抛出，求小球撞击地面前一刻的速率



8. 力 F 作用于一原来是静止的 1.2kg 物体。F 随时间 t 的变化如以上线图所示。求该物体于 t=8s 时的动能

9. 1.5kg 小车以速率 3 ms^{-1} 沿水平光滑面移动。一块质量为 0.5kg 的泥胶由 0.8m 高坠下，刚落在小车上。求加载了小车的速度。