

**Problems of Dynamics**

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- 1) A 14–kg block is pulled along a level surface by a force of 129 N at an angle of  $45^\circ$ . The surface has a coefficient of friction of 0.2. Find: **a)** Normal force and frictional force. **b)** Acceleration of the block. **c)** Displacement of the block and its speed in a time interval of 5 s.

*Data:*  $g = 9.8 \text{ m/s}^2$ .

*Answer:* **a)** 45.98 N, 9.2 N, **b)** 5.86  $\text{m/s}^2$ , **c)** 73.23 m, 29.29 m/s.

- 2) An 160–N force is applied to a 20–kg block resting on a horizontal frictionless table. Find: **a)** Its acceleration. **b)** Its speed and its displacement in a time interval of 7 s.

*Answer:* **a)** 8  $\text{m/s}^2$ , **b)** 56 m/s, 196 m.

- 3) An 132–N force is applied to a 24–kg block resting on a horizontal table. The table has a coefficient of friction of 0.15. Find: **a)** Frictional force. **b)** Acceleration of the block. **c)** Displacement of the block in a time interval of 11 s.

*Data:*  $g = 9.8 \text{ m/s}^2$ .

*Answer:* **a)** 35.28 N, **b)** 4.03  $\text{m/s}^2$ , **c)** 243.82 m.

- 4) A 41–kg block is pulled along a level surface by a force of 406 N at an angle of  $30^\circ$ . The surface has a coefficient of friction of 0.2. Find: **a)** Normal force and frictional force. **b)** Acceleration of the block. **c)** Displacement of the block and its speed in a time interval of 11 s.

*Data:*  $g = 9.8 \text{ m/s}^2$ .

*Answer:* **a)** 198.8 N, 39.76 N, **b)** 7.61  $\text{m/s}^2$ , **c)** 460.16 m, 83.67 m/s.

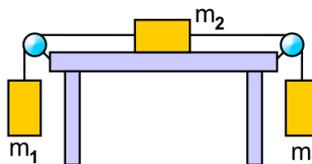
- 5) A 66–N force is applied to a 22–kg block resting on a horizontal frictionless table. Find: **a)** Its acceleration. **b)** Its speed and its displacement in a time interval of 7 s.

*Answer:* **a)** 3  $\text{m/s}^2$ , **b)** 21 m/s, 73.5 m.

- 6) Three blocks are connected on the table as shown in the figure below. The table is rough and has a coefficient of kinetic friction of 0.25. The blocks have masses of  $m_1 = 3 \text{ kg}$ ,  $m_2 = 8 \text{ kg}$ , and  $m_3 = 17 \text{ kg}$ . If the pulleys are massless and frictionless, determine:

- a)** Value of the frictional force.  
**b)** Acceleration of the blocks.  
**c)** The tensions in the two cords.

*Data:*  $g = 9.8 \text{ m/s}^2$ .



*Answer:* **a)** 19.6 N, **b)** 4.2  $\text{m/s}^2$ , **c)** 42 N, 95.2 N.

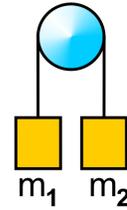
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7) Below is a picture of an Atwood's Machine: two blocks attached to a frictionless, massless pulley. The blocks have masses of  $m_1 = 7 \text{ kg}$  and  $m_2 = 13 \text{ kg}$ . Calculate:

- a) Acceleration of the blocks.
- b) Tension in the cord.
- c) Time required for  $m_2$  to fall 25 m.

Data:  $g = 9.8 \text{ m/s}^2$ .

Answer: a)  $2.94 \text{ m/s}^2$ , b)  $89.18 \text{ N}$ , c)  $4.124 \text{ s}$ .

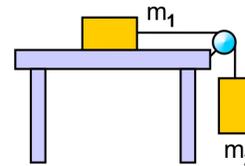


8) In the drawing, the mass of the block on the table is  $m_1 = 5 \text{ kg}$  and that of the hanging block is  $m_2 = 9 \text{ kg}$ . If the coefficient of kinetic friction is 0.2 and assuming the pulley to massless, find:

- a) Acceleration of the blocks and value of the frictional force.
- b) Tension in the cord.
- c) Time required for  $m_2$  to fall 70 m.

Data:  $g = 9.8 \text{ m/s}^2$ .

Answer: a)  $5.6 \text{ m/s}^2$ ,  $9.8 \text{ N}$ , b)  $37.8 \text{ N}$ , c)  $5 \text{ s}$ .

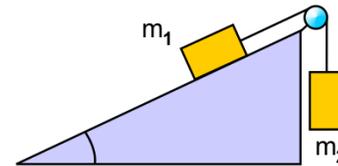


9) Two blocks are connected by a light string that passes over a frictionless pulley, as in the figure below. The plane is inclined at an angle of  $30^\circ$ , its coefficient of kinetic friction is 0.26,  $m_1 = 6 \text{ kg}$  and  $m_2 = 20 \text{ kg}$ , find:

- a) Acceleration of the blocks and value of the frictional force.
- b) The tension in the string.
- c) Time required for  $m_2$  to fall 58 m.

Data:  $g = 9.8 \text{ m/s}^2$ .

Answer: a)  $5.9 \text{ m/s}^2$ ,  $13.24 \text{ N}$ , b)  $78.03 \text{ N}$ , c)  $4.435 \text{ s}$ .



10) Three blocks are connected on the table as shown in the figure below. The table is rough and has a coefficient of kinetic friction of 0.32. The blocks have masses of  $m_1 = 8 \text{ kg}$ ,  $m_2 = 6 \text{ kg}$ , and  $m_3 = 22 \text{ kg}$ . If the pulleys are massless and frictionless, determine:

- a) Value of the frictional force.
- b) Acceleration of the blocks.
- c) The tensions in the two cords.

Data:  $g = 9.8 \text{ m/s}^2$ .

Answer: a)  $18.82 \text{ N}$ , b)  $3.29 \text{ m/s}^2$ , c)  $104.71 \text{ N}$ ,  $143.25 \text{ N}$ .

