Total time: 1 hr **Total Points: 10 pt** **Student Name:**

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

$$\text{speed} = \frac{\text{distance}}{\text{time}} \qquad \text{velocity} = \frac{\text{displacement}}{\text{time}} \qquad \text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$g = 9.8\ \text{m/s}^2$ $F = ma$ $F_g = mg$ $F_{fr} = \mu F_N$ Torque = Force × Lever Arm

1. The coefficient of static friction for steel on steel is 0.58. If the normal force is 60 N, what is the maximum static friction you can have?

Solution: Static friction can be anythin between zero and $0.58 \times F_N$. So the maximum friction is

$$0.58 \times 60\ \text{N} = 34.8\ \text{N}$$

2. If the kinetic friction is 30 N and the normal friction is 100 N, what is the kinetic coefficient of friction?

Solution:

$$F_{fr} = \mu \times F_N$$
$$30 = \mu \times 100$$
$$\mu = \frac{30}{100} = 0.3$$

3. An earthmover slows from 15.0 km/h to 3.00 km/h in 2.70 s. What is its rate of deceleration?

Solution: The speed changes from 4.167 m/s to 0.833 m/s in 2.70 s

$$\text{acceleration} = \frac{0.833 - 4.167}{2.70} = -1.23\ \frac{\text{m}}{\text{s}^2}$$

4. A rocket accelerates at 10.0 $\frac{\text{m}}{\text{s}^2}$ from rest for 20.0 s. Find its increase in speed?

Solution:

$$\text{speed} = \text{initial speed} + \text{acceleration} \times \text{time}$$
$$\text{Increase in speed} = 10.0\ \frac{\text{m}}{\text{s}^2} \times 20.00\ \text{s} = 200\ \text{m/s}$$

5. Find the weight of a 1150-kg automobile in N?

Solution:

$$1,150 \text{ kg} \times 9.8 \frac{\text{m}}{\text{s}^2} = 11,270 \text{ N}$$

6. What is the mass of a 20,000-N truck?

Solution:

$$\text{weight} = mg$$

$$m = \frac{weight}{g} = \frac{20,000}{9.8} = 2,040 \text{ kg}$$

7. Find the acceleration produced by a total force of 93.0 N on a mass of 6.00 kg

Solution:

$$a = \frac{93.0}{6.00} = 15.5 \frac{\text{m}}{\text{s}^2}$$

8. Find the total force necessary to give each an object with mass 15.0 kg an acceleration of 2.00 $\frac{\text{m}}{\text{s}^2}$.

Solution:

$$F = 15.0 \times 2.00 = 30.00 \text{ N}$$

9. Find the total force necessary to give an automobile of mass 120 slugs an acceleration of 11.0 ft/s^2.

Solution: We do not need to convert in the metric units. Both numbers are consistent and will give us the answer in force lb

$$120 \times 11.0 = 1,320 \text{ lb}$$

10. A truck of mass 13,100 kg is acted upon by a driving force of 8900 N. The motion is opposed by a frictional force of 2230 N. Find the acceleration

Solution: If 8,900 N act on the truck, but 2230 N of friction oppose it, then the total force on the truck is $8,900 - 2,230 = 6670$ N.

$$F_{net} = ma$$

$$6670 = (13,100 \text{ kg}) \times (a)$$

$$a = \frac{6670}{13,100} = 0.51 \frac{\text{m}}{\text{s}^2}$$

11. A force of 20.0 N is applied at a distance of 0.3 m, what is the torque N.m?

Solution:

$$20.0 \text{ N} \times 0.3 \text{ m} = 6.0 \text{ N.m}$$

12. If you apply 35.0 lb force at a distance of 0.5 ft, what is the torque in ft.lb?

Solution:

$$35.0 \text{ lb} \times 0.5 \text{ ft} = 17.5 \text{ ft.lb}$$

13. If the torque on a shaft of radius 2.37 cm is 38.0 N.m, what force is applied to the shaft?

Solution: We need to convert the units for the radius from cm to m: 2.37 cm = 0.0237 m

$$\text{torque} = \text{force} \times \text{lever arm}$$

$$\text{force} = \frac{\text{torque}}{\text{lever arm}} = \frac{38.0}{0.0237} = 1,603 \text{ N}$$