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Force Fundamentals

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**Exercise 1**

Describe what is meant by the following terms?

1. Scalar quantities: A scalar quantity possesses magnitude but no direction
eg. Mass-20kg; Length 500mm; Time 30 secs.
2. Vector quantities: A vector quantity possesses both magnitude and direction
eg. Force, Velocity, Acceleration.

**Exercise 2**

Complete the table by classifying the following quantities as vectors or scalars.

|  |  |  |
| --- | --- | --- |
| **Quality** |  | **Scalar or Vector** |
| 1 hour 35 mins | Time | Scalar |
| 80 kg | Mass | Scalar |
| 10 m/s North | Velocity/Direction | Vector |
| 4m2 | Length | Scalar |
| 9.8 m/s-2 vertical down | Acceleration/Direction | Vector |
| 24 m/s South East | Velocity/Direction | Vector |
| 4.5 m | Length | Scalar |
| 50 N vertically up | Force Magnitude/Direction | Vector |
| 1 m3 | Volume | Scalar |
| 10 s | Time | Scalar |
| 25 km in a North East  | Velocity/direction | Vector |
| 1 × 10⁹ | Magnitude | Scalar |

**Exercise 3**

Determine the force created in a vertical down direction by a stack of six {6) boxes each with a mass of 6.5 kg. Use the analytical (mathematical) method.

Start with a formula and show all workings. M = 6.5 × 6 = 39kg

 F = 39 × 10

 = 390 N

**Exercise 4**

1. Determine the force created in a vertical downward

direction by a toaster that has a mass of 6.4 kg.

M = 6.4kg

A = g = 10m/s-²

 F = m a Force: \_\_64N\_\_

 = 6.4 × 10

 = 64N

1. The toaster now has four 25 gram slices of bread in the slots. Calculate the new vertical downward force created by the loaded toaster.

Mass of toaster = 6.4kg F = m a

Mass of toaster = 4 × .025 = 6.5 × 10

 = .1kg = 65N

 Total mass = 6.5kg

 A = g = 10m/s-² Force: 65N\_\_

**Exercise 5**

What is the magnitude of the force exerted by the floor on each leg of the table of mass 50 kg.

What are these forces called?

Mass of table = 50kg

Force exerted by table

F = m a

 = 50 × 10

 = 500N

Force exerted by floor on legs Magnitude of force: 125N\_\_

= 500/4 The force is called a Reaction

= 125N

**Exercise 6**

Determine the tension in the cable supporting the spring balance. The spring balance has a mass of 2 kg and it is showing a reading of 20 kg.

 Total mass = 22kg.

 A = g = 10m/s²

 F = m a

 = 22 × 10

 = 220



**Exercise 7**

Find the values:

1. mass M
2. Tl
3. T2

 Note the mass of the cable is 1.5 kg

1. Mass M is reading on scales 15kg.
2. Tension 1

M = 15kg. F = m a

 A = g = 10 m/s² = 16.5 × 10

 = 165N

1. Tension 2

M = 15 + 1.5 F = m a Mass: \_\_\_15kg\_\_\_\_

 = 16.5kg = 16.5 × 10 Tension 1: \_\_\_150N\_\_\_\_

 = 165N Tension 2: \_\_\_165N\_\_\_\_

**Exercise 8**





**Exercise 9**

**A**

**Exercise 10**

**A**

**Exercise 11**

**Exercise 12**



**Exercise 13**

**Exercise 14**

**Exercise 15**



**Exercise 16**



**Exercise 17**

**Exercise 17 (Continued)**

