**Equation 1**

1. Write down the equation that links gravitational field strength, weight and mass.
2. Calculate the weight (N) for the following:

***Show all of your workings***

* 1. mass = 15 kg gravitational field strength = 9.8 N/kg
  2. mass = 4.3 kg gravitational field strength = 9.8 N/kg
  3. mass = 70 kg gravitational field strength = 9.8 N/kg
  4. mass = 26 kg gravitational field strength = 1.6 N/kg
  5. mass = 70 kg gravitational field strength = 1.6 N/kg

1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. weight = 150 N gravitational field strength = 9.8 N/kg
  2. weight = 12 N gravitational field strength = 9.8 N/kg
  3. weight = 8000 N gravitational field strength = 9.8 N/kg
  4. weight = 9.6 N gravitational field strength = 1.6 N/kg
  5. weight = 1.0 N gravitational field strength = 1.6 N/kg

1. Calculate the gravitational field strength (N/kg) for the following:

***Show all of your workings***

* 1. mass = 60 kg weight = 106 N
  2. mass = 60 kg weight = 222 N
  3. mass = 150 kg weight = 240 N
  4. mass = 26 kg weight = 520 N
  5. mass = 4.4 kg weight = 43.1 N

5. Work out the answers to the following questions. Some will require you to convert the units. ***Show all of your workings***

1. Calculate the weight of an object that has a mass of 65 kg on Earth, where g = 9.8 N/kg.
2. Calculate the weight of an object that has a mass of 65 kg on the Moon, where g = 1.6 N/kg.
3. A rocket on Mars, where g = 3.7 N/kg, has a weight of 740000 N. Calculate its mass.
4. An astronaut of mass 95 kg lands on a large planet. On the surface he weighs 1400 N. What is the gravitational field strength on this planet?
5. An apple has a weight of 1.4 N on Earth, where g = 9.8 N/kg. What is its mass? Give your answer in grams.

**Equation 2**

1. Write down the equation that links force, distance moved and work done.
2. Calculate the work done (J) for the following:

***Show all of your workings***

* 1. distance = 15 m force = 10 N
  2. distance = 300 m force = 5 N
  3. distance = 9.4 m force = 0.2 N
  4. distance = 550 m force = 2.4 N
  5. distance = 1.5 m force = 8 N

1. Calculate the distance moved (m) for the following:

***Show all of your workings***

* 1. work done = 12 J force = 10 N
  2. work done = 9.2 J force = 5 N
  3. work done = 0.3 J force = 0.12 N
  4. work done = 22000 J force = 200 N
  5. work done = 1500 J force = 45 N

1. Calculate the force (N) for the following:

***Show all of your workings***

* 1. distance moved = 4 m work done = 36 J
  2. distance moved = 720000 m work done = 8000 J
  3. distance moved = 174 m work done = 1200 J
  4. distance moved = 0.75 m work done = 625 J
  5. distance moved = 12.4 m work done = 0.80 J

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. How much work must be done to move an object 45 m against a frictional force of 60 N?
  2. A large book was moved 210 cm. It required 735 J of work to do this. What force was used?
  3. It takes 1800 J of work to bring a bike to a halt. The braking force is 150 N. What distance did the bike travel before it stopped?
  4. 320 KJ of mechanical work is done by a motor to pull an object 1.6 km. What force is applied on the object by the motor?
  5. A person has a weight of 70 N. He runs up three flights of stairs of total height 13 m. How much work has he done?

**Equation 3**

1. Write down the equation that links spring constant, force applied to a spring and extension.
2. Calculate the force applied to a spring (N) for the following:

***Show all of your workings***

* 1. spring constant = 120 N/m extension = 0.6 m
  2. spring constant = 6 N/m extension = 0.2 m
  3. spring constant = 26000 N/m extension = 0.055 m
  4. spring constant = 28 N/m extension = 1.4 m
  5. spring constant = 0.2 N/m extension = 0.04 m

1. Calculate the spring constant (N/m) for the following:

***Show all of your workings***

* 1. extension = 0.75 m force applied to the spring = 200 N
  2. extension = 1.1 m force applied to the spring = 5.5 N
  3. extension = 0.03 m force applied to the spring = 18 N
  4. extension = 0.1 m force applied to the spring = 2300 N
  5. extension = 0.5 m force applied to the spring = 11500 N

1. Calculate the extension (m) for the following:

***Show all of your workings***

* 1. force applied to the spring = 640 N spring constant = 1280 N/m
  2. force applied to the spring = 45 N spring constant = 600 N/m
  3. force applied to the spring = 14000 N spring constant = 70000 N/m
  4. force applied to the spring = 218 N spring constant = 900 N/m
  5. force applied to the spring = 2.2 N spring constant = 36 N/m

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A spring is extended by 0.6 metres. It has a spring constant of 44 N/m. What force was applied to it to cause this extension?
  2. A force of 1500 N is used to stretch a spring. It extends by 0.35 m. What must its spring constant be? Answer to two significant figures.
  3. A spring has a spring constant of 124 N/cm. A force of 196 N is applied to it. How much will it extend by?
  4. How much force is required to extend a spring by 15 cm if the spring constant is 3 N/cm?
  5. A spring for a car suspension must only change in length by 2.5 cm when a force of 15000 N is applied to it. What spring constant should the spring have?

**Equation 4**

1. Write down the equation that links distance travelled, time and speed.
2. Calculate the distance travelled (m) for the following:

***Show all of your workings***

* 1. speed = 12 m/s time = 4 s
  2. speed = 30 m/s time = 42 s
  3. speed = 640 m/s time = 3 s
  4. speed = 330000 m/s time = 0.02 s
  5. speed = 10.4 m/s time = 9.62 s

1. Calculate the speed (m/s) for the following:

***Show all of your workings***

* 1. distance travelled = 400 m time = 50 s
  2. distance travelled = 60 m time = 1.5 s
  3. distance travelled = 42200 m time = 7400 s
  4. distance travelled = 120000 m time = 7200 s
  5. distance travelled = 4.5 m time = 16 s

1. Calculate the time (s) for the following:

***Show all of your workings***

* 1. speed = 60 m/s distance travelled = 24000 m
  2. speed = 1.9 m/s distance travelled = 12 m
  3. speed = 0.001 m/s distance travelled = 0.05 m
  4. speed = 1.5 m/s distance travelled = 3000 m
  5. speed = 15.4 m/s distance travelled = 22.8 m

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A sprinter can achieve 11 m/s. If he runs for 14 seconds at this speed, what distance will he travel?
  2. A motorcyclist travels for 8.5 km at an average speed of 25 m/s. How long does it take him?
  3. A runner covers 1500 m in 260 seconds. What is their average speed during the race? Give your answer to two significant figures.
  4. For 5 minutes an object moves at 320 m/s. How far does it go?
  5. A car moves at 58 km/h. How much time does it take to cover 20 km? Answer to two significant figures.

**Equation 5**

1. Write down the equation that links acceleration, change in velocity and time taken.
2. Calculate the acceleration (m/s2) for the following:

***Show all of your workings***

* 1. change in velocity = 39 m/s time taken = 6.5 s
  2. change in velocity = 80 m/s time taken = 27.5 s
  3. change in velocity = 30000 m/s time taken = 120 s
  4. change in velocity = 520 m/s time taken = 0.2 s
  5. change in velocity = 14.2 m/s time taken = 3.12 s

1. Calculate the change in velocity (m/s) for the following:

***Show all of your workings***

* 1. time taken = 4 s acceleration = 8 m/s2
  2. time taken = 28 s acceleration = 4.5 m/s2
  3. time taken = 150 s acceleration = 27 m/s2
  4. time taken = 0.25 s acceleration = 1600 m/s2
  5. time taken = 18 s acceleration = 17.5 m/s2

1. Calculate the time taken (s) for the following:

***Show all of your workings***

* 1. acceleration = 1.5 m/s2 change in velocity = 45 m/s
  2. acceleration = 21000 m/s2 change in velocity = 700 m/s
  3. acceleration = 78 m/s2 change in velocity = 9600 m/s
  4. acceleration = 0.32 m/s2 change in velocity = 0.96 m/s
  5. acceleration = 0.71 m/s2 change in velocity = 13 m/s

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. Dwayne Dolt starts a race and reaches 11 m/s after 4 seconds. What is his acceleration?
  2. A bullet leaves a gun after 0.15 seconds. If it leaves at 525 m/s, what was its average acceleration whilst in the gun?
  3. How long would it take a train to increase in velocity by 38.5 m/s if it accelerated at 3.5 m/s2.
  4. A rocket accelerates for 2 minutes at 29.4 m/s2. What is its change in velocity in this time? Give your answer to two significant figures.
  5. How long would it take to go from 340 m/s to 3640 m/s if accelerating at 9.8 m/s2. Give your answer to the nearest second.

**Equation 6**

1. Write down the equation that links mass, acceleration and resultant force.
2. Calculate the force (N) for the following:

***Show all of your workings***

* 1. mass = 8.2 kg acceleration = 4.5 m/s2
  2. mass = 2100 kg acceleration = 3.4 m/s2
  3. mass = 0.24 kg acceleration = 2.3 m/s2
  4. mass = 70 kg acceleration = 5.3 m/s2
  5. mass = 0.08 kg acceleration = 1600 m/s2

1. Calculate the acceleration (m/s2) for the following:

***Show all of your workings***

* 1. force = 3.6 N mass = 1.2 kg
  2. force = 78000 N mass = 3200 kg
  3. force = 350 N mass = 65 kg
  4. force = 72 N mass = 0.0006 kg
  5. force = 3.23 N mass = 0.33 kg

1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. acceleration = 3.0 m/s2 force = 180 N
  2. acceleration = 9.8 m/s2 force = 686 N
  3. acceleration = 1400 m/s2 force = 70 N
  4. acceleration = 33.4 m/s2 force = 703 N
  5. acceleration = 0.025 m/s2 force = 1.25 N

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. What resultant force is required to accelerate a mass of 1300 kg by 3.5 m/s2?
  2. A cyclist creates a forwards force of 175 N as he starts to cycle. He and his bicycle have a combined mass of 82 kg. What acceleration will he experience?
  3. A falling apple experiences a downwards gravitational force of 1.8 N. If it is accelerating at 9.8 m/s2, what is its mass?
  4. A car is pushed forwards with a resultant force of 18 kN. It has a mass of 1200 kg. What acceleration will it experience?
  5. A box being dragged across a floor is pulled with a forwards force of 218 N and feels a backwards force of friction of 178 N. If it is accelerating at 2.5 m/s2, what mass must it have?

**Equation 7**

1. Write down the equation that links mass, momentum and velocity.
2. Calculate the momentum (kg m/s) for the following:

***Show all of your workings***

* 1. mass = 65 kg velocity = 11 m/s
  2. mass = 385 kg velocity = 42 m/s
  3. mass = 1500 kg velocity = 15 m/s
  4. mass = 0.0015 kg velocity = 0.35 m/s
  5. mass = 2500000 kg velocity = 3500 m/s

1. Calculate the mass (kg) for the following:

***Show all of your workings***

* 1. velocity = 4 m/s momentum = 280 kg m/s
  2. velocity = 550 m/s momentum = 16.5 kg m/s
  3. velocity = 1500 m/s momentum = 2250 kg m/s
  4. velocity = 38 m/s momentum = 1.5 kg m/s
  5. velocity = 3.6 m/s momentum = 57000 kg m/s

1. Calculate the velocity (m/s) for the following:

***Show all of your workings***

* 1. momentum = 15 kg m/s mass = 0.625 kg
  2. momentum = 75 kg m/s mass = 45 kg
  3. momentum = 1.5 kg m/s mass = 3.1 kg
  4. momentum = 0.0340 kg m/s mass = 0.00017 kg
  5. momentum = 600 kg m/s mass = 105 kg

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A car has a mass of 2400 kg and a velocity of 11 m/s. What is its momentum?
  2. If an object is required to have a momentum of 18000 kg m/s and it has a mass of 450 kg, how fast must it be moving?
  3. A tennis ball has a velocity of 35 m/s and a mass of 58 g. What is its momentum?
  4. An object has a momentum of 0.035 kg m/s and a velocity of 7.8 m/s. What must its mass be? Give you answer in grams.
  5. If a train has a mass of 7.2 × 105 kg, what will its momentum be when it is travelling at 64 m/s?

**Equation 8**

1. Write down the equation that links wave speed, frequency and wavelength.
2. Calculate the wave speed (m/s) for the following:

***Show all of your workings***

1. frequency = 16 Hz wavelength = 3.75 m
2. frequency = 40 Hz wavelength = 8.75 m
3. frequency = 1.2 Hz wavelength = 275 m
4. frequency = 5 Hz wavelength = 242 m
5. frequency = 45 Hz wavelength = 72 m
6. Calculate the wavelength (m) for the following:

***Show all of your workings***

* 1. wave speed = 4539 m/s frequency = 150 Hz
  2. wave speed = 3575 m/s frequency = 55 Hz
  3. wave speed = 6320 m/s frequency = 200 Hz
  4. wave speed = 330 m/s frequency = 220 Hz
  5. wave speed = 2496.1 m/s frequency = 229 Hz

1. Calculate the frequency (Hz) for the following:

***Show all of your workings***

* 1. wavelength = 15 m wave speed = 120 m/s
  2. wavelength = 8 m wave speed = 264 m/s
  3. wavelength = 1.5 m wave speed = 3240 m/s
  4. wavelength = 1620 m wave speed = 6318 m/s
  5. wavelength = 132 m wave speed = 330 m/s

1. Work out the answers to the following questions. Some will require you to convert the units.

***Show all of your workings***

* 1. A wave has a wavelength of 15 cm and a frequency of 0.14 Hz. Calculate its speed.
  2. A wave has a wavelength of 4 nm and a frequency of 7.5 × 1013 Hz. Calculate its speed.
  3. A wave travels at 3.0 × 108 m/s and has a frequency of 2.5 MHz. Calculate its wavelength.
  4. A wave that travels at 3.0 × 108 m/s and has a frequency of 6.0 × 1014 Hz. Calculate the wavelength of the wave in nanometres.
  5. A wave travels at 3.0 × 108 m/s and has a wavelength of 12 nm frequency of 2.5 x1016 Hz. Calculate its frequency.

**Answers**

**Equation 1**

**1** Weight (N) = mass (kg) × gravitational field strength (N/kg)

**2 (a)** 15 kg × 9.8 N/kg = 147 N

**(b)** 4.3 kg × 9.8 N/kg = 42.1 N

**(c)** 70 kg × 9.8 N/kg = 686 N

**(d)** 26 kg × 1.6 N/kg = 41.6 N

**(e)** 70 kg × 1.6 N/kg = 112 N

3 **(a)** 150 N ÷ 9.8 N/kg = 15.3 kg

**(b)** 12 N ÷ 9.8 N/kg = 1.2 kg

**(c)** 8000 N ÷ 9.8 N/kg = 816 kg

**(d)** 9.6 N ÷ 1.6 N/kg = 6.0 kg

**(e)** 1.0 N ÷ 1.6 N/kg = 0.63 kg

4 **(a)** 106 N ÷ 60 kg = 1.77 N/kg

**(b)** 222 N ÷ 60 kg = 3.7 N/kg

**(c)** 240 N ÷ 150 kg = 1.6 N/kg

**(d)** 520N ÷ 26 kg = 20 N/kg

**(e)** 43.1 N ÷ 4.4 kg = 9.80 N/kg

5 **(a)** 65 kg × 9.8 N/kg = 637 N

**(b)** 65 kg × 1.6 N/kg = 104 N

**(c)** 740000 N ÷ 3.7 N/kg = 200000 kg

**(d)** 1400 N ÷ 95 kg = 14.7 N/kg

**(e)** 1.4 N ÷ 9.8 N/kg = 0.14 kg = 140 g

**Equation 2**

**1** Work done (J) = Force (N) × distance moved(m)

**2 (a)** 10 N × 15 m = 150 J

**(b)** 5 N × 300 m = 1500 J

**(c)** 0.2 N × 9.4 m = 1.88 J

**(d)** 2.4 N × 550 m = 1320 J

**(e)** 8 N × 1.5 m = 12 J

3 **(a)** 12 J ÷ 10 N = 1.2 m

**(b)** 9.2 J ÷ 5 N = 1.84 m

**(c)** 0.3 J ÷ 0.12 N = 2.5 m

**(d)** 22000 J ÷ 200 N = 110 m

**(e)** 1500 J ÷ 45 N = 33 m

4 **(a)** 36 J ÷ 4 m = 9 N

**(b)** 8000 J ÷ 720000 m = 0.011 N

**(c)** 1200 J ÷ 174 m = 6.9 N

**(d)** 625 J ÷ 0.75 m = 833 N

**(e)** 0.80 J ÷ 12.4 m = 0.065 N

5 **(a)** 60 N × 45 m = 2700 J

**(b)** 735 J ÷ 2.1 m = 350 N

**(c)** 1800 J ÷ 150 N = 12 m

**(d)** 320000 J ÷ 1600 m = 200 N

**(e)** 70 N × 13 m = 910 J

**Equation 3**

**1**

**2 (a)** 120 N/m × 0.6 m = 72 N

**(b)** 6 N/m × 0.2 m = 1.2 N

**(c)** 26000 N/m × 0.056 m = 1430 N

**(d)** 28 N/m × 1.4 m = 39.2 N

**(e)** 0.2 N/m × 0.04 m = 0.008 N

3 **(a)** 200 N ÷ 0.75 m = 267 N/m

**(b)** 5.5 N ÷ 1.1 m = 5 N/m

**(c)** 18 N ÷ 0.03 m = 600 N/m

**(d)** 2300 N ÷ 0.1 m = 23000 N/m

**(e)** 11500 N ÷ 0.5 m = 23000 N/m

4 **(a)** 640 N ÷ 1280 N/m = 0.5 m

**(b)** 45 N ÷ 600 N/m = 0.075 m

**(c)** 14000 N ÷ 70000 N/m = 0.2 m

**(d)** 218 N ÷ 900 N/m = 0.24 m

**(e)** 2.2 N ÷ 36 N/m = 0.061 m

5 **(a)** 44 N/m × 0.6 m = 26.4 N

**(b)** 1500 N ÷ 0.35 m = 4286 N/m = 4300 N/m to two sig. figs.

**(c)** 196 N ÷ 124 N/m = 1.58 m

**(d)** 300 N/m × 0.15 m = 45 N

**(e)** 15000 N ÷ 0.025 m = 600000 N/m (or 6000 N/cm)

**Equation 4**

**1**

**2 (a)** 12 m/s × 4 s = 48 m

**(b)** 30 m/s × 42 s = 1260 m

**(c)** 640 m/s × 3 s = 1920 m

**(d)** 330000 m/s × 0.02 s = 6600 m

**(e)** 10.4 m/s × 9.62 s = 100 m

3 **(a)** 400 m ÷ 50 s = 8 m/s

**(b)** 60 m ÷ 1.5 s = 40 m/s

**(c)** 42200 m ÷ 7400 s = 5.7 m/s

**(d)** 120000 m ÷ 7200 s = 17 m/s

**(e)** 4.5 m ÷ 16 s = 0.28 m/s

4 **(a)** 24000 m ÷ 60 m/s = 400 s

**(b)** 12 m ÷ 1.9 m/s = 6.3 s

**(c)** 0.05 m ÷ 0.001 m/s = 50 s

**(d)** 3000 m ÷ 1.5 m/s = 2000 s

**(e)** 22.8 m ÷ 15.4 m/s = 1.48 s

5 **(a)** 11 m/s × 14 s = 154 m

**(b)** 8500 m ÷ 25 m/s = 340 s

**(c)** 1500 m ÷ 260 s = 5.769 m/s = 5.8 m/s to two sig. figs.

**(d)** 320 m/s × 300 s = 96000 m (or 96 km)

**(e)** 20000 m ÷ 16.1 m/s = 1241 s = 1200 s to two sig. figs.

**Equation 5**

**1**

**2 (a)** 39 m/s ÷ 6.5 s = 6.0 m/s2

**(b)** 80 m/s ÷ 27.5 s = 2.91 m/s2

**(c)** 30000 m/s ÷ 120 s = 250 m/s2

**(d)** 520 m/s ÷ 0.2 s = 2600 m/s2

**(e)** 14.2 m/s ÷ 3.12 s = 4.55 m/s2

3 **(a)** 8 m/s2 × 4 s = 32 m/s

**(b)** 4.5 m/s2 × 28 s = 126 m/s

**(c)** 27 m/s2 × 150 s = 4050 m/s

**(d)** 1600 m/s2 × 0.25 s = 400 m/s

**(e)** 17.5 m/s2 × 18 s = 315 m/s

4 **(a)** 45 m/s ÷ 1.5 m/s2 = 30 s

**(b)** 700 m/s ÷ 21000 m/s2 = 0.033 s

**(c)** 9600 m/s ÷ 78 m/s2 = 123 s

**(d)** 0.96 m/s ÷ 0.32 m/s2 = 3.0 s

**(e)** 13 m/s ÷ 0.71 m/s2 = 18.3 s

5 **(a)** 39 m/s ÷ 6.5 s = 6.0 m/s2

**(b)** 525 m/s ÷ 0.15 s = 3500 m/s2

**(c)** 38.5 m/s ÷ 3.5 m/s2 = 11 s

**(d)** 29.4 m/s2 × 120 s = 3528 m/s = 3500 m/s

**(e)** 3300 m/s ÷ 9.8 m/s2 = 337 s

**Equation 6**

**1**

**2 (a)** 8.2 kg × 4.5 m/s2 = 36.9 N

**(b)** 2100 kg × 3.4 m/s2 = 7140 N

**(c)** 0.24 kg × 2.3 m/s2 = 0.055 N

**(d)** 70 kg × 5.3 m/s2 = 371 N

**(e)** 0.08 kg × 1600 m/s2 = 128 N

3 **(a)** 3.6 N ÷ 1.2 kg = 3 m/s2

**(b)** 78000 N ÷ 3200 kg = 24.4 m/s2

**(c)** 350 N ÷ 65 kg = 5.4 m/s2

**(d)** 72 N ÷ 0.0006 kg = 120000 m/s2

**(e)** 3.23 N ÷ 0.33 kg = 9.79 m/s2

4 **(a)** 180 N ÷ 3.0 m/s2 = 60 kg

**(b)** 686 N ÷ 9.8 m/s2 = 70 kg

**(c)** 70 N ÷ 1400 m/s2 = 0.05 kg

**(d)** 703 N ÷ 33.4 m/s2 = 21.0 kg

**(e)** 1.25 N ÷ 0.025 m/s2 = 50 kg

5 **(a)** 1300 kg × 3.5 m/s2 = 4550 N

**(b)** 175 N ÷ 82 kg = 2.13 m/s2

**(c)** 1.8 N ÷ 9.8 m/s2 = 0.18 kg

**(d)** 18000 N ÷ 1200 kg = 15 m/s2

**(e)** 40 N ÷ 2.5 m/s2 = 16 kg

**Equation 7**

**1**

**2 (a)**

**(b)**

**(c)**

**(d)**

**(e)**

**3** **(a)** 280 kgm/s ÷ 4 m/s = 70 kg

**(b)** 16.5 kgm/s ÷ 550 m/s = 0.03 kg

**(c)** 2250 kgm/s ÷ 1500 m/s = 1.5 kg

**(d)** 1.5 kgm/s ÷ 38 m/s = 0.039 kg

**(e)** 57000 kgm/s ÷ 3.6 m/s = 15800 kg

4 **(a)** 15 kg m/s ÷ 0.625 kg = 24 m/s

**(b)** 75 kg m/s ÷ 45 kg = 1.7 m/s

**(c)** 1.5 kg m/s ÷ 3.1 kg = 0.48 m/s

**(d)** 0.0340 kg m/s ÷ 0.00017 kg = 200 m/s

**(e)** 600 kg m/s ÷ 105 kg = 5.7 m/s

5 **(a)**

**(b)** 1800 kg m/s ÷ 450 kg = 4 m/s

**(c)**

**(d)** 0.035 kg m/s ÷ 7.8 m/s = 0.0045 kg = 4.5 g

**(e)** 7.2 × 105 kg × 64 m/s = 4.6 × 107 kgm/s

**Equation 8**

**1**

**2 (a)** 16 Hz × 3.75 m = 60 m/s

**(b)** 40 Hz × 8.75 m = 350 m/s

**(c)** 1.2 Hz × 275 m = 330 m/s

**(d)** 5 Hz × 242 m = 1210 m/s

**(e)** 45 Hz × 72 m = 3240 m/s

**3** **(a)** 4539 m/s ÷ 150 Hz = 30.26 m

**(b)** 3575 m/s ÷ 55 Hz = 65 m

**(c)** 6320 m/s ÷ 200 Hz = 31.6 m

**(d)** 330 m/s ÷ 220 Hz = 1.5 m

**(e)** 2496.1 m/s ÷ 229 Hz = 10.9 m

4 **(a)** 120 m/s ÷ 15 m = 8 Hz

**(b)** 264 m/s ÷ 8 m = 33 Hz

**(c)** 3240 m/s ÷ 1.5 m = 2160 Hz

**(d)** 6318 m/s ÷ 1620 m = 3.9 Hz

**(e)** 330 m/s ÷ 132 m = 2.5 Hz

5 **(a)** 0.14 Hz × 0.15 m = 0.021 m/s

**(b)** 7.4 × 1013 Hz × 4 × 109 m = 3.0 × 108 m/s

**(c)** 3.0 × 108 m/s × 2.5 × 106 Hz = 120m

**(d)** 3.0 × 108 m/s × 6.0 × 1014 Hz = 3.0 × 10-7 m = 300 nm

**(e)** 3.0 × 108 m/s ÷ 12 × 10-9 = 2.5 × 1016 Hz