Week 3 Answers – Worksheets

Newton's 2nd Law Hwk 2

CP2d.6 Acceleration calculations Homework 2

1 **a** resultant force 26 N, downwards, 0.5 m/s^2

b resultant force 2 N, downwards, 0.002 m/s^2

2 sprinter – 160 N
charging elephant – 1 m/s^2
racing car – 4500 N
cyclist – 100 kg
bullet – 40 000 m/s^2
hockey ball – 0.13 kg

3 **a** 180 000 m/s^2

b 8100 N

4 **a** –0.0072 m/s^2 (accept the number without the minus sign, as sign conventions for directions have not been discussed)

b 2 160 000 N

5 **a** The mass of an object found by dividing the resultant force acting on it by the acceleration produced by the force.

b Both values will be the same.

6 A car is accelerating as it corners. The acceleration is towards the centre of the circle and experiences a centripetal force directed towards the centre of the circle. This is provided by friction between the tyres and the road. For a lower mass car, the force needed to achieve this acceleration is less, so the car is less likely to skid.

7 **a** acceleration = 140 000 N / 28 000 kg
= 5 m/s^2

b change in speed = acceleration × time
= 5 m/s^2 × 10 s = 50 m/s

c the force given in the question remains the same/there are no other forces acting on the fighter

d The actual speed will be less, because as the fighter gains speed the drag forces will increase so the resultant force will decrease.

Newton's 2nd Law Hwk 1

CP2d.5 Acceleration calculations Homework 1

1 a 50 N
b 75 N
c 160 N
d 160 N

2 a greater
b smaller

3 a resultant force 8 N, to the left, 4 m/s^2
b resultant force 2 N, to the right, 10 m/s^2
c resultant force 3 N, upwards, 0.75 m/s^2
d resultant force 5 N, upwards, 0.5 m/s^2
e resultant force 100 N, to the right, 40 m/s^2
f resultant force 6 N, upwards, 0.6 m/s^2

Mass and Weight

CP2c.3 Mass and weight – Strengthen

1 a Mass is the amount of matter in an object.
b kilograms

2 a Weight is the force of gravity pulling on an object.
b newtons

3 a Mass, field strength
b 2, 10
c 20

4 2 × 3.7 = 7.4

5 Mass = 40 N / 3.7 N/kg = 10.8 kg

Gravity and Weight

CP2c.5 Gravity and weight 1

1 Force, gravity, newtons; mass, strength, gravitational, N/kg; matter, kilograms

2 a Weight
b Mass
c Gravitational field strength
d Mass, gravitational field strength

3 a Weight = 3000 kg × 10 N/kg = 30 000 N
b Downwards arrow on balloon a little shorter than the upthrust arrow shown.
c 34 000 N – 30 000 N = 4000 N upwards
d It will increase in an upwards direction.

4 Mass = weight / g = 28 000 N / 10 N/kg = 2800 kg

Challenge: Stored Energy Equations

CP3d.3 Stored energies – Equations

1 a ΔGPE = 4 kg × 10 N/kg × 2 m = 80 J
b ΔGPE = 2.5 kg × 10 N/kg × 3 m = 75 J
c ΔGPE = 0.5 kg × 10 N/kg × 2.5 m = 12.5 J
d mass = 800 J/(10 N/kg × 2 m) = 40 kg
e Δh = 1125 J/(75 kg × 10 N/kg) = 1.5 m
f Δh = 1500 J/(50 kg × 10 N/kg) = 3 m
g mass = 50 J/(10 N/kg × 0.5 m) = 10 kg

2 a ΔGPE = 2 kg × 1.6 N/kg × 1.5 m = 4.8 J
b g = 11.1 J/(2 kg × 1.5 m) = 3.7 N/kg
c g = 280 000 J/(400 kg × 500 m) = 1.4 N/kg

3 a $KE = 0.5 \times 0.16\ kg \times (44\ m/s)^2 = 154.9\ J$
b $KE = 0.5 \times 0.4\ kg \times (30\ m/s)^2 = 180\ J$
c $KE = 0.5 \times 0.15\ kg \times (30\ m/s)^2 = 67.5\ J$
d mass = 185 J/(0.5 × (48 m/s)^2) = 0.16 kg
e mass = 142 J/(0.5 × (70 m/s)^2) = 0.058 kg
f $KE = 0.5 \times 0.0027\ kg \times (40\ m/s)^2 = 2.16\ J$
g mass = 186.3 J/(0.5 × (90 m/s)^2) = 0.046 kg

4 a $KE = 0.5 \times 1500\ kg \times (10\ m/s)^2 = 75\,000\ J$
b $KE = 0.5 \times 1500\ kg \times (20\ m/s)^2 = 300\,000\ J$
c $KE = 0.5 \times 1500\ kg \times (30\ m/s)^2 = 675\,000\ J$

5 bounce 1, GPE = 0.02 kg × 10 N/kg × 1.4 m
= 0.28 J

bounce 2, GPE = 0.02 kg × 10 N/kg × 1.0 m
= 0.20 J

bounce 3, height = 0.14 J/(0.02 kg × 10 N/kg)
= 0.7 m

bounce 4, height = 0.10 J/(0.02 kg × 10 N/kg)
= 0.5 m

bounce 5, height = 0.07 J/(0.02 kg × 10 N/kg)
= 0.35 m

6 bounce 3: v^2 = 0.14 J/(0.5 × 0.02 kg)
= 14 (m/s)^2, v = 3.74 m/s

bounce 4: v^2 = 0.10 J/(0.5 × 0.02 kg)
= 10 (m/s)^2, v = 3.16 m/s

bounce 5: v^2 = 0.07 J/(0.5 × 0.02 kg)
= 7 (m/s)^2, v = 2.65 m/s

7 **a** ΔGPE = 30 kg × 10 N/kg × 0.5 m = 150 J

b v^2 = 150 J/(0.5 × 30 kg) = 10 (m/s)^2,
v = 3.16 m/s

8 **a** ΔGPE = 5000 kg × 10 N/kg × 6 m
= 300 000 J

v^2 = 300 000 J/(0.5 × 5000 kg) = 120 (m/s)^2,
v = 10.95 m/s

b ΔGPE = 5000 kg × 10 N/kg × 3 m = 150 000 J

v^2 = 150 000 J/(0.5 × 5000 kg) = 60 (m/s)^2,
v = 7.75 m/s