1. The diagram shows the forces acting on a parachutist in free fall.

The parachutist has a mass of 75 kg.

Calculate the weight of the parachutist.

Gravitational field strength = 10 N/kg

Show clearly how you work out your answer and give the unit.

Weight =

weight = mass × gravitational field strength

$$W = m\,g$$

- weight, N
- mass, kg
- gravitational field strength, m/s^2

2. A pulley is used to lift some bricks up. The weight of the bricks is 100 N and they are lifted 3 m.

Calculate the work done on the bricks.

Answer ..... J

work done = force × distance

$$W = Fs$$

- *work done, J*
- *force, N*
- *distance, m*

3. A weight is placed on a spring to stretch the spring elastically from a length of 23 cm to a new length of 30 cm. The weight is 343 N.

Write down the equation which links compression, force and spring constant.

.....

Calculate the spring constant of the spring. Give your answer in newtons per metre.

..... N/m

force applied to a spring = spring constant × extension

$$F = k\,e$$

- *force applied to spring, N*
- *spring constant, N/m*
- *extension, m*

4. A van was driven for 20 seconds at a speed of 30 m/s.

Calculate the distance travelled.

Distance = ... m

$$\text{distance} = \text{speed} \times \text{time}$$

$$s = v\,t$$

- distance, m
- speed, m/s
- time, s

5. A van was travelling at 30 m/s. It slowed to a stop in 12 seconds.

Calculate the van's acceleration.

Acceleration = ... m/s^2

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$a = \frac{\Delta v}{t}$$

- *acceleration, m/s^2*
- *change in velocity, m/s*
- *time taken, s*

6. The mass of a car is 1120 kg. The mass of the driver is 80 kg.

Calculate the resultant force acting on the car and driver while accelerating at 5.6 m/s^2

Resultant force = ... N

$$\text{resultant force} = \text{mass} \times \text{acceleration}$$

$$F = m\,a$$

- *resultant force, N*
- *mass, kg*
- *acceleration, m/s^2*

7.

Vehicle	Speed (m/s)	Mass (kg)
Motorbike	14	175
Lorry	14	10 000
Van	14	3 000

Which vehicle has the greatest momentum?

.....

Give a reason:

Showing your working, calculate the momentum of the motorbike:

Higher Tier only

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$p = m\,v$$

- *momentum, kg m/s*
- *mass, kg*
- *velocity, m/s*

8. The molten rock flowing from an erupting volcano can reach a speed of 8 m/s.

i. Write down the equation that links kinetic energy, mass and speed.

ii. Calculate the kinetic energy of 1 tonne of molten rock flowing at 8 m/s.
(1 tonne = 1 000 kg)

Kinetic energy = ... joules

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

$$E_k = \tfrac{1}{2} m\,v^2$$

- *kinetic energy, J*
- *mass, kg*
- *speed, m/s*

9. A child has a mass of 18 kilograms, he goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N / kg

..... N / kg

Gravitational potential energy (GPE) equation:

$$\text{GPE} = \text{mass} \times \text{gravitational field strength} \times \text{height}$$

$$Ep = m\,g\,h$$

- *gravitational potential energy, J*
- *mass, kg*
- *gravitational field strength, N/kg*
- *height, m*

10. It takes a climber 800 seconds to climb to the top of a 20 metre cliff.

During this time the energy transferred to the climber equals 12 000 J.
Calculate the power of the climber during the climb.

Power = ... W

$$\text{power} = \frac{\text{energy transferred}}{\text{time}}$$

$$P = \frac{E}{t}$$

- *power, W*
- *energy transferred, J*
- *time, s*

11. A student did 2240 J of work going from the bottom of the stairs to the top of the stairs.

The student took 2.8 seconds to run up the stairs.

Calculate the power the student developed when running up the stairs.

Power = ... W

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$P = \frac{W}{t}$$

- *power, W*
- *work done, J*
- *time, s*

12. A fuel-burning power station has an efficiency of 30%.

Calculate the chemical energy of the fuel required for a useful energy output of 600 joules per second.

Chemical energy of the fuel = ... J/s

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

13. A man is using a leaf blower to move some leaves. The total power input to the leaf blower is 750 W.The useful power output of the leaf blower is 360 W.

Calculate the efficiency of the leaf blower.

Efficiency = ...

$$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

14. A bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

Speed = ... m/s

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$v = f\,\lambda$$

- *wave speed, m/s*
- *frequency, Hz*
- *wavelength, m*

15. A mains electricity supply causes a current of 11 amps to flow through the cable.

Calculate the amount of charge that flows through the cable when the cable is switched on for 2 hours and give the unit.

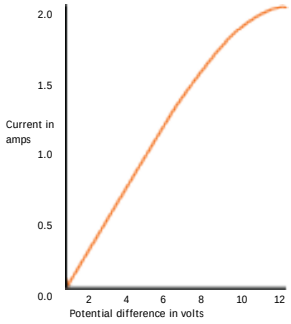
Charge = ...

$$\text{charge flow} = \text{current} \times \text{time}$$

$$Q = I\,t$$

- *charge flow, C*
- *current, A*
- *time, s*

16. The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.



Calculate the resistance of the bulb when the potential difference is 8 V.

potential difference = current × resistance

$$V = I\,R$$

- *potential difference, in volts, V*
- *current, in amps, A*
- *resistance, in ohms, Ω*

17. A kettle has a power rating of 2 kW. Mains electricity has a potential difference of 230 V.

Calculate the current that flows when the kettle is switched on.

Current = ……. A

power = potential difference × current

$$P = V\,I$$

- *power, W*
- *potential difference, V*
- *current, A*

18. A mains electricity cable has a resistance of 5 mΩ.

Calculate the power loss due to resistance when a current of 13 A flows in this cable.

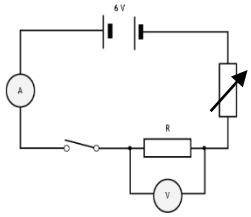
Power loss = ……A

power = (current)^2 × resistance

$$P = I^2\,R$$

- *power, W*
- *current, A*
- *resistance, Ω*

19. The diagram shows an electrical circuit.



For 20 coulombs of charge to flow through the resistor R, 100 joules of work must be done.

Calculate the potential difference reading given by the voltmeter.

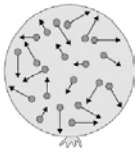
Potential difference = ... V

energy transferred = charge flow × potential difference

$$E = Q\,V$$

- *energy transferred, J*
- *charge flow, C*
- *potential difference, V*

20. A helium balloon has a mass of 0.00254 kg.



The balloon has a volume of 0.0141 m^3.
Calculate the density of helium.

Density = ... unit .....

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\rho = \frac{m}{V}$$

- *density, kg/m^3*
- *mass, kg*
- *volume, m^3*

21. Some students fill an empty plastic bottle with water.
The weight of the water in the bottle is 24 N and the cross-sectional area of the bottom of the bottle is 0.008 m^2.

Calculate the pressure of the water on the bottom of the bottle.

Pressure = ... N/m^2

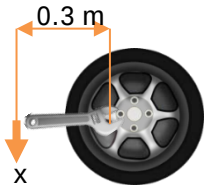
Physics only

$$\text{pressure} = \frac{\text{force normal to a surface}}{\text{area of that surface}}$$

$$p = \frac{F}{A}$$

- *pressure, N/m^2*
- *force, N*
- *area, m^2*

22. A person wants to undo a wheel nut using a spanner.



A moment of 75 Nm is needed to undo the wheel nut.

The spanner is 0.3 m long.

Calculate the force, **X**, the person needs to exert to undo the wheel nut.

Force = ... N

Physics only

$$\text{moment of a force} = \text{force} \times \text{distance}$$

$$M = F\,d$$

- *moment of a force, Nm*
- *force, N*
- *distance, m*

(NB: Distance, d, is the perpendicular distance from the pivot to the line of action of the force, in metres, m.)

Teaching notes and answers

The cards can be cut out, folded in half and laminated to produce a set of cards.

They could be used as flashcards – show students the question and ask them to recall the equation needed to solve it.

The cards could also be tied together into sets and used as reference tool for students or as example questions.

1. 750 N
2. 300 J
3. 49 N/m
4. 600 m
5. 2.5 m/s^2
6. 6 720 N
7. The lorry has the greatest momentum. Motorbike momentum = 2 450 kg m/s
8. 32 000 J
9. 450 N/kg
10. 15 W
11. 800 W
12. 20 J/s
13. 48 %
14. 0.34 m/s
15. 7 200 C
16. 5.3 Ω
17. 460 000 A
18. 0.845 A
19. 5 V
20. 0.01801 kg/m^3
21. 3000 N/m^2
22. 250 N