Calculation Practice

Combined and Triple Science

Topic Number	Topic Area	Sections to complete
2	Motion & Forces	1, 2, 3, 4, 5, 22 & 23
3	Conservation of Energy	6, 7 & 8
4	Waves	9 & 10
8	Energy – Forces doing work	6, 7, 8, 11 & 12
10	Electricity & Circuits	12, 14, 15, 16, 17, 18 & 24
12	Magnetism	25
13	Electromagnetic Induction	26 & 27
14	Particle model	19, 28 & 29
15	Forces & Matter	20 & 31
Triple Physics	Forces & Effects	13
Triple Physics	Forces & Matter	21 & 32
Triple Physics	Particle Model	30

Symbol Equations	*Word Equations*	*Unit Equations*	*Symbols*		*Name and Unit*	
$x = av\,x\,t$	$distance = average\ speed\ x\ time$	$(m) = \left(\frac{m}{s}\right) x\ (s)$	x	Δh	Distance (m) Meters	Height (m) Meters
$a = \frac{(v-u)}{t}$	$acceleration = \frac{change\ in\ velocity}{time\ taken}$	$(\frac{m}{s^2}) = \frac{(\frac{m}{s})}{(s)}$	av	P	Speed (m/s) Meters / second	Power (W) Watts
$\mathrm{F} = m\ x\ a$	$force = mass\ x\ acceleration$	$(N) = (Kg)\ x\ (\frac{m}{s^2})$	t	E	Time (s) Seconds	Energy (J) Joules
$\mathrm{W} = m\ x\ g$	$weight = mass\ x\ gravitational\ field\ strength$	$(N) = (Kg)\ x\ (\frac{N}{Kg})$	a	Q	Acceleration (m/s^2) Meters per second squared	Charge (C) Coulombs
$\mathbf{p = m\ x\ v}$	$\boldsymbol{momentum\ = mass\ x\ velocity}$	$\boldsymbol{\left(Kg.\frac{m}{s}\right) = (Kg) x\ (\frac{m}{s})}$	v	V	End velocity (m/s) Meters per second	Voltage (V) Volt
$\mathrm{v} = f\ x\,\lambda$	$wave\ speed\ = frequency\ x\ wavelength$	$\left(\frac{m}{s}\right) = (Hz)\ x\ (m)$	u	I	Start velocity (m/s) Meters per second	Current (A) Amps
$v = \frac{x}{t}$	$wave\ speed = \frac{distance}{time}$	$(\frac{m}{s}) = \frac{(m)}{(s)}$	F	R	Force (N) Newtons	Resistance (Ω) Ohms
$\mathrm{E} = F\ x\ d$	$work\ done\ = force\ x\ distance\ moved$	$(J) = (N)\ x\ (m)$	m	P	Mass (Kg) Kilograms	Power (W) Watts
$\Delta GPE = m\ x\ g\ x\ \Delta h$	$\Delta GPE\ = mass\ x\ gravitational\ fieldx\ vertical\ height$	$(J) = (Kg)\ x\ \left(\frac{N}{Kg}\right) x\ (m)$	W	k	Power (W) Watts	Constant No Unit
$KE = \frac{1}{2} x\ m\ x\ v^2$	$\Delta Kinetic\ Energy\ = \frac{1}{2}\ x\ mass\ x\ (speed)^2$	$(J) = \frac{1}{2}\ x\ (Kg)\ x\ (\frac{m}{s})$	g	X	Gravity (N/Kg) Newtons per kilo	Extension (m) Meters
$\rho = \frac{m}{V}$	$density = \frac{mass}{volume}$	$(\frac{kg}{L}) = \frac{(Kg)}{(L)}$	p	G-	Momentum ($Kg.ms^{-1}$) Kilogram meters/ sec	Giga- 10^9
$P = \frac{E}{t}$	$power\ = \frac{work\ done}{time\ taken}$	$(W) = \frac{(J)}{(s)}$	f	M-	Frequency (Hz) Hertz	Mega- 10^6
$P = \frac{E}{t}$	$power\ = \frac{energy\ transferred}{time\ taken}$	$(W) = \frac{(J)}{(s)}$	λ	K-	Wavelength (m) Meters	Kilo- 10^3
$\mathrm{E} = Q\ x\ V$	$energy\ transferred\ = charge\ moved\ x\ voltage$	$(J) = (C)\ x\ (V)$	ρ	c-	Density (Kg/m^3) Kilogram / meter cubed	Centi- 10^2
$Q = I\ x\ \mathrm{t}$	$charge = current\ x\ time$	$(C) = (A)\ x\ (s)$	V	m-	Volume (m^3 Meters cubed	Milli- 10^{-3}
$V = I\ x\ R$	$voltage = current\ x\ resistance$	$(V) = (A)\ x\ (\Omega)$	E	µ-	Work Done (J) Joules	Micro- 10^{-6}
$P = I\ x\ V$	$electrical\ power = current\ x\ voltage$	$(W) = (A)\ x\ (V)$	F	n-	Force (N) Newtons	Nano- 10^{-9}
$P = I^2\ x\ R$	$electrical\ power\ = (current)^2\ x\ resistance$	$(W) = (A)\ x\ (\Omega)$	d	p-	Distance (m) Meters	Pico- 10^{-12}
$F = k\ x\ \times$	$force\ on\ a\ spring = spring\ constant\ x\ extension$	$(F) = (k)\ x\ (m)$	ΔGPE		Energy (J) Joules	

Click for practice. Click the top of the page to return.

$d = s \times t$

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

$F = m \times a$

$W = m \times g$

$p = m \times v$

$E_P = m \times g \times \Delta h$

$E_K = \frac{1}{2} \times m \times v^2$

$efficiency = \frac{useful\ energy\ out}{total\ energy\ in}$

$v = f \times \lambda$

$v = \frac{d}{t}$

$W = F \times d$

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

$M = F \times d$

$E = Q \times V$

$Q = I \times t$

$V = I \times R$

$P = I \times V$

$P = I^2 \times R$

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

$F = k \times e$

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

Grade 4	Grade 6	Grid

$v^2 - u^2 = 2 \times a \times d$

$F = \frac{(mv - mu)}{t}$

$E = V \times I \times t$

$F = B \times I \times l$

$\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$V_p \times I_p = V_s \times I_s$

$E = m \times c \times \theta$

$E = m \times L$

$P_1 \times V_1 = P_2 \times V_2$

$E = \frac{1}{2} \times k \times e^2$

$p = h \times \rho \times g$

1	$d = s \times t$	d	Distance Travelled	m
		s	Speed	m/s
		t	Time Taken	s

d	s	t		d	s	t
	15	28			0.3	180
	7	17			55.5	0.4
700		35		450		22
500		60		320		16
200	8			52 000	64.5	
1700	75			6400	330	

Click here for rearranged equation

Distance and speed:

A. **Calculate the distance a car will travel in 30s when moving at 12m/s.**
B. **How long will it take a pupil to walk to a lesson 70m away at 1.5m/s?**
C. **What is the speed (*in m/s*) of a car that travels 30km in 45 minutes?**

1	$d = s \times t$	d	Distance Travelled	m
		s	Speed	m/s
		t	Time Taken	s

d	s	t
420	15	28
119	7	17
700	20	35
500	8.33	60
200	8	25
1700	75	22.67

d	s	t
54	0.3	180
22.2	55.5	0.4
450	20.4	22
320	20	16
52 000	64.5	806.20
6400	330	19.39

Distance & Speed

a. 360m

b. 46.67 s

c. 11.11m/s

d = s x t

$$s = \frac{d}{t}$$

$$t = \frac{d}{s}$$

2	$a = \frac{\Delta v}{t}$	a	Acceleration	m/s^2
		Δv	Change in Velocity	m/s
		t	Time Taken	s

a	Δv	t
	30	10
	40	5
2		30
10		19
6	84	
3	24	

a	Δv	t
	4	5
	8	50
5.3		22
4		6.2
30	9	
5	1250	

A. Calculate the acceleration of a sprinter who takes 0.70s to reach their maximum speed of 11m/s.

B. A penny dropped accelerates at 9.8m/s. How fast will it travel when it hits the bottom 3.6s later?

C. How many seconds will it take a car to accelerate from 45km/hr to 90km/hr at $1.5m/s^2$?

Start t	End	t	Δv	a
10	6	2		
60	30	5		

Start t	End	t	Δv	a
18.6	12.4	4		
35	42	7.2		

Click here for rearranged equation

2	$a = \frac{\Delta v}{t}$	a	Acceleration	m/s^2
		Δv	Change in Velocity	m/s
		t	Time Taken	s

a	Δv	t
3	30	10
8	40	5
2	60	30
10	190	19
6	84	14
3	24	8

a	Δv	t
0.8	4	5
0.16	8	50
5.3	116.6	22
4	24.8	6.2
30	9	0.3
5	1250	250

Star t	End	t	Δv	a
10	6	2	-4	-2
60	30	5	-30	-6

Star t	End	t	Δv	a
18.6	12.4	4	-6.2	-1.55
35	42	7.2	+7	+0.97

Acceleration & Speed

a. $15.7\ m/s^2$

b. 35.28 m/s

c. 8.33 s

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

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

$$\Delta V = a \times t$$

3	F = m x a	*a*	Acceleration	m/s^2
		F	Force	N
		M	Mass	kg

a	*F*	*m*
	35	7
	84	6
5		10
7		94
8	64	
10	125	

a	*F*	*m*
	4	0.64
	7.1	238
6.8		1237
9.42		0.56
3.5	20.5	
7.25	109	

A. Calculate the force necessary to accelerate a 10kg mass by $17m/s^2$.

B. What acceleration will a car of mass 1100kg experience if a force of 550N acts on it?

C. An aircraft's engines provide a thrust of 240kN. What is its mass if it accelerates by $8.0m/s^2$?

Click here for rearranged equation

3	F = m x a	*a*	Acceleration	m/s^2
		F	Force	N
		M	Mass	kg

Force & Acceleration

a. 1.5 W

b. 3.166.67 s

c. 43200 J

a	*F*	*m*
5	35	7
14	84	6
5	50	10
7	658	94
8	64	8
10	125	12.5

a	*F*	*m*
6.25	4	0.64
0.029	7.1	238
6.8	8411.6	1237
9.42	5.28	0.56
3.5	20.5	5.86
7.25	109	15.03

$F = m \times a$

$M = \frac{F}{a}$

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

4	$W = m \times g$	g	Gravitational Field Strength	**N/kg**
		m	Mass	**Kg**
		W	Weight	**N**

g	m	W
	400	2000
	1.9	50
1.6		34
10		82
10	5	
10	90	

g	m	W
	175	1825
	0.4	0.55
9.81		254
2.5		12 000
9.81	0.05	
23	45.3	

Click here for rearranged equation

A. Calculate the weight of a 45kg girl

B. A box weighs 49N. What is its mass?

C. A 85kg astronaut in orbit weighs only 23mN. What is the gravitational field strength?

4	$W = m \times g$	g	Gravitational Field Strength	N/kg
		m	Mass	Kg
		W	Weight	N

g	m	W
5	400	2000
26.32	1.9	50
1.6	**21.25**	34
10	**8.2**	82
10	5	**50**
10	90	**900**

g	m	W
10.43	175	1825
1.375	0.4	0.55
9.81	**25.89**	254
2.5	**4800**	12 000
9.81	0.05	**0.49**
23	45.3	**1041.9**

F = m x a

$$m = \frac{F}{a}$$

$$a = \frac{F}{m}$$

Weight

a. 441 N
b. 5 kg
c. 2.7×10^{4} N/Kg

5	$p = m \times v$	m	Mass	Kg
		p	Momentum	Kg m/s
		v	Velocity	m/s

m	p	v
	100	5
	98	7
7		3
5		12
50	125	
15	105	

m	p	v
	460 000	15
	0.27	90
20 000		4.5
0.0056		82
325	7.5×10^4	
1.3×10^3	351	

A. Calculate the momentum of a bullet of mass 0.010kg travelling at 400m/s.

B. A bike and rider have a combined momentum of 1000kgm/s. If their velocity is 12m/s, what is their combined mass?

C. What is the velocity of a 58g tennis ball with a momentum of 2.4kgm/s?

Click here for rearranged equation

5	$p = m \times v$	m	Mass	Kg
		p	Momentum	Kg m/s
		v	Velocity	m/s

m	p	v
20	100	5
14	98	7
7	21	3
5	60	12
50	125	2.5
15	105	7

m	p	v
30 666.67	460 000	15
0.003	0.27	90
20 000	90 000	4.5
0.0056	0.46	82
325	7.5×10^4	230.77
1.3×10^3	351	0.27

$p = m \times v$

$m = \frac{p}{v}$

$v = \frac{p}{m}$

Momentum

a. 4 Kg m/s
b. 83.3 Kg
c. 41.38 m/s

6	$E_p = m \times g \times \Delta h$	h	Change in Height	m
		g	Gravitational Field Strength	N/Kg
		E_P	Gravitational Potential Energy	J
		m	Mass	Kg

h	E_P	m
	40000	35
	57000	60
20		70
25		1500
18	150	
0.4	1700	

h	E_P	m
	6120	2.5
	229	53
2.5		18
15		90
72	1.8×10^5	
6.5	0.31	

Click here for rearranged equation

These calculations are on Earth where ***g* =10**

These calculations are on the Moon where ***g* =1.6**

A. Calculate the gravitational potential energy gained when a 700kg light aircraft takes off to an altitude of 500m.

B. What height can a 40kg rock reach if it gains 2 800J of gravitational potential energy?

C. What is the mass of a bird that loses 50J of gravitational potential energy when it dives from a 20m cliff?

D. A robot on the surface of Mars has a mass of 190kg. It gains 620kJ of gravitational potential energy when it climbs 0.85km up a hill. What is the strength of gravity on Mars?

6	Ep = m x g x Δh	h	Change in Height	**m**
		g	Gravitational Field Strength	**N/Kg**
		E_P	Gravitational Potential Energy	**J**
		m	Mass	**Kg**

GPE

a. 3.43×10^6 J
b. 7.14 m
c. 0.255 Kg
d. 3.84 N/Kg

h	E_P	m
11.43	40000	35
95	57000	60
20	**14 000**	70
25	**375 000**	1500
18	150	**0.83**
0.4	1700	**425**

h	E_P	m
1530	6120	2.5
2.70	229	53
2.5	**725**	18
15	**2160**	90
72	1.8×10^5	**1 562.5**
6.5	0.31	**0.03**

These calculations are on Earth where ***g* =10**   These calculations are on the Moon where ***g* =1.6**

Ep = m x g x Δh

$$m = \frac{Ep}{g \times \Delta h}$$

$$g = \frac{Ep}{m \times \Delta h}$$

$$\Delta h = \frac{Ep}{g \times m}$$

7	Ek = ½ x m x v²	E_K	Kinetic Energy	J
		m	Mass	Kg
		v	Speed	m/s

E_K	m	v
	200	9
	10	0.5
80		4
17600		8
1872	208	
2000	0.004	

E_K	m	v
	250	3.5
	0.08	12.3
9		20
279		2.4
7.2	0.05	
640 000	1600	

Click here for rearranged equation

A. **Calculate the kinetic energy of a bullet of mass 0.010kg travelling at 400m/s.**
B. **A car has a kinetic energy of 50 000J when travelling at 10m/s. What is the mass of the car?**
C. **A bowler's arm does 90J of work when throwing an 80g rounders ball. What is the speed of the ball?**

7	$E_k = \frac{1}{2} \times m \times v^2$	E_K	Kinetic Energy	J
		m	Mass	Kg
		v	Speed	m/s

E_K	m	v		E_K	m	v
8100	200	9		**382 812.5**	250	3.5
1.25	10	0.5		**6.05**	0.08	12.3
80	**10**	4		9	**0.045**	20
17600	**550**	8		279	**96.88**	2.4
1872	208	**4.24**		7.2	0.05	**16.97**
2000	0.004	**1000**		640 000	1600	**28.28**

Power & Energy

a. **1.5 W**

b. **3.166.67 s**

c. **43200 J**

$$E_k = \frac{1}{2} \times m \times v^2$$

$$\frac{E_k}{0.5 \times v^2} = m$$

$$\sqrt{\left(\frac{E_k}{0.5 \times m}\right)} = v$$

8	$efficiency = \frac{\text{useful energy}}{\text{total input}}$

Efficiency	*Useful Out*	*Total In*
	1500	2000
	60	300
0.50		2000
0.20		600
0.90	200	
0.05	4000	

Efficiency	*Useful Out*	*Total In*
	10	200
	1050	1500
6%		50 000
57%		2530
85%	5990	
35%	2100	

Click here for rearranged equation

A. Calculate the efficiency of a device that usefully shifts 20J of energy when supplied with 50J.

B. A microwave oven has an efficiency of 60%. How much does the internal energy store of a bowl of baked beans increased when 80 000J of energy is supplied to the oven?

C. A wind farm has an efficiency of 0.17. If it supplies 120TJ of energy to the National Grid, how much energy was in the wind's kinetic store?

A. Calculate the efficiency of a 60W lightbulb that emits 2.0W of visible light.

B. A washing machine has an efficiency of 20%. If the power supplied is 1 200W, how much power is usefully shifted?

C. Steam trains have very low efficiencies – around 5.0%. If it needed 50MW to pull the carriages, what power must have been supplied?

8	$efficiency = \frac{\text{useful energy}}{\text{total input}}$

Efficiency	*Useful Out*	*Total In*
0.75	1500	2000
0.2	60	300
0.50	**1000**	2000
0.20	**120**	600
0.90	200	**222.22**
0.05	4000	**80 000**

Efficiency	*Useful Out*	*Total In*
0.05	10	200
0.7	1050	1500
6%	**3000**	50 000
57%	**1442.1**	2530
85%	5990	**7041.1**
35%	2100	**6000**

Efficiency & Energy

a. **0.4**
b. **48 000J**
c. **706 TJ (7.06×10^{14} J)**

Efficiency & Power

a. **0.33**
b. **240 W**
c. **1 GW (1×10^{9} W)**

Efficiency = $\frac{\text{useful energy}}{\text{total input}}$

Useful = Efficiency x input

Input = $\frac{\text{useful}}{\text{efficiency}}$

9	$V = f \times \lambda$	Symbol	Quantity	Unit
		f	Frequency	**Hz**
		λ	Wavelength	**m**
		v	Wave Speed	**m/s**

f	λ	v
	0.3	7
	0.4	5
25		256
450		330
2	12	
125	20	

f	λ	v
	1500	400
	7.5×10^{-7}	30 000 000
525		215
7×10^{14}		30 000 000
1.2	256	
360 000	0.0004	

Click here for rearranged equation

A. **Calculate the speed of a water wave with a wavelength of 10m and a frequency of 0.25Hz.**

B. **The speed of sound is 340m/s. What is the wavelength of a sound wave with a frequency of 256Hz?**

C. **All electromagnetic waves travel at the same speed: 3.0×10^8m/s. What is the frequency of green light, having a wavelength of 540nm?**

9	$V = f \times \lambda$	f	Frequency	Hz
		λ	Wavelength	m
		v	Wave Speed	m/s

f	λ	v	f	λ	v
23.3	0.3	7	**0.27**	1500	400
35.8	0.4	5	**4×10^{13}**	7.5×10^{-7}	30 000 000
25	**10.24**	256	525	**0.41**	215
450	**0.73**	330	7×10^{14}	**4.29×10^{-8}**	30 000 000
2	12	**24**	1.2	256	**307.2**
125	20	**2500**	360 000	0.0004	**144**

Wave Speed

a. 1.5 W

b. 3.166.67 s

c. 43200 J

$$V = f \times \lambda$$

$$f = \frac{V}{\lambda}$$

$$\lambda = \frac{V}{f}$$

10	$V = \frac{d}{t}$	*d*	Distance	**m**
		t	Time	**s**
		v	Wave Speed	**m/s**

d	*t*	*v*
	300	500
	0.25	80
30 000		750
10 680		445
144 000	720	
2112	6	

d	*t*	*v*
	20	17
	10	15
1062		64
336		14
500	25	
59	0.05	

Click here for rearranged equation

10	$V = \frac{d}{t}$	*d*	Distance	**m**
		t	Time	**s**
		v	Wave Speed	**m/s**

d	*t*	*v*
150 000	300	500
20	0.25	80
30 000	**40**	750
10 680	**24**	445
144 000	720	**342.86**
2112	6	**352**

d	*t*	*v*
340	20	17
150	10	15
1062	**16.59**	64
336	**24**	14
500	25	**20**
59	0.05	**1180**

$$V = \frac{d}{t}$$

$$d = V \times t$$

$$t = \frac{d}{V}$$

11	W = F x d	d	Distance Moved in Direction of Force	m
		F	Force	N
		W	Work Done	J

d	F	W
	50	300
	8	120
1.5		128
150		36 000
12	5	
2.5	50	

d	F	W
	125	100 000
	200	6120
135		4050
0.003		6
0.5	750	
3.75	7.2	

Click here for rearranged equation

A. Calculate the work done when a box is pushed 20m against 7.0N of friction.
B. What is the force if 24J is needed to move 6.0m?
C. It takes 30MJ to fire a sounding rocket that weighs 750N. How high does the rocket go?

11	**W = F x d**	*d*	Distance Moved in Direction of Force	**m**
		F	Force	**N**
		W	Work Done	**J**

d	*F*	*W*
6	50	300
15	8	120
1.5	**85.3**	128
150	**240**	36 000
12	5	**60**
2.5	50	**125**

d	*F*	*W*
800	125	100 000
30.6	200	6120
135	**30**	4050
0.003	**2000**	6
0.5	750	**375**
3.75	7.2	**27**

Work Done

a. **140 J**

b. **4 N**

c. **4×10^4 m**

$$W = F \times d$$

$$F = \frac{W}{d}$$

$$d = \frac{W}{F}$$

12	$P = \frac{E}{t}$	*E*	Energy Transferred	J
		P	Power	W
		t	Time	s

E	*P*	*t*
	50	3
	1000	15
4800		120
7440		14
96	3	
110	550	

E	*P*	*t*
	24	54.2
	120.4	7.3
842 240		175
4650		12.4
1311	43	
66 500	536	

A. Calculate the power of a torch when the battery's chemical energy store empties by 45J in 30s.
B. A rower develops a power of 600W. How long will the 1 900 000J of chemical energy in a Mars bar allow them to row?
C. A mobile phone has an average power of 0.50W. How much chemical energy must be stored in the battery if it can power the phone for an entire day?

A. Calculate the power of a machine that does 700J of work in 35s.
B. How long does it take a machine rated at 250W to do 75J of work?
C. A car develops a power of 20kW when driving along a motorway. If it is driven for 2 hours, how much work does the car do against air resistance?

Click here for rearranged equation

A. Calculate the energy transferred by a 6.0W light bulb in 60s.
B. How long will a 50W heater take to deliver 200J of energy?
C. What is the power of a shower that delivers 3.7MJ of energy in 7.0 minutes?

12	$P = \frac{E}{t}$	*E*	Energy Transferred	J
		P	Power	W
		t	Time	s

E	*P*	*t*
150	50	3
15000	1000	15
4800	**40**	120
7440	**531.4**	14
96	3	**32**
110	550	**0.2**

E	*P*	*t*
1300.8	24	54.2
878.92	120.4	7.3
842 240	**4812.8**	175
4650	**375**	12.4
1311	43	**30.49**
66 500	536	**124.07**

Power & Energy

a. 1.5 W

b. 3.166.67 s

c. 43200 J

Power & Work

a. 20 W

b. 0.3 s

c. 2 400 000 J (2 400 KJ)

Energy Transferred & Power

a. 360 J

b. 4 s

c. 8809.52 W

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

$$E = P \times t$$

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

13	M = F x d	d	Distance Normal to the Force	m
		F	Force	N
		M	Moment of a Force	N/m

d	F	M
	5	15
	8	48
1.2		360
9		81
0.1	45	
0.3	1400	

d	F	M
	700	600
	250	75
0.6		480
1.75		280
6.4	6000	
0.2	900	

Click here for rearranged equation

A. Calculate the moment of a force of 30N acting a distance of 0.40m from a pivot.

B. A moment of 4.5Nm is balanced by a force acting 0.90m from the pivot. What is the size of the force?

C. A crane supports a force of 280kN which causes a moment of 1.4×10^4Nm. How long is the jib?

13	M = F x d	d	Distance Normal to the Force	m
		F	Force	N
		M	Moment of a Force	N/m

d	F	M
3	5	15
6	8	48
1.2	300	360
9	9	81
0.1	45	4.5
0.3	1400	420

d	F	M
0.86	700	600
0.3	250	75
0.6	800	480
1.75	160	280
6.4	6000	38 400
0.2	900	180

Moment of a Force

a. 12 Nm
b. 5 N
c. 0.05 m

$$F = \frac{M}{d}$$

$$d = \frac{M}{F}$$

$$M = F \times d$$

14	E = V x Q	Q	Charge	C
		E	Energy Transferred	J
		V	Potential Difference	V

Q	E	V
	16800	734
	500 000	2400
2.4		3
3		17
27	15	
0.6	72	

Q	E	V
	0.23	15.1
	175 000	1825
785		5
4.3		1.5
74	239	
30	600	

Click here for rearranged equation

A. **Calculate the energy transferred by 4.0C in 6.0s.**

B. **How much charge must flow through 8.0V to do 4.0J of work?**

C. **A spark transfers 0.20μC of charge doing 0.040J of work – what was the p.d.?**

14	E = V x Q	Q	Charge	C
		E	Energy Transferred	J
		V	Potential Difference	V

Q	E	V
22.89	16800	734
208.33	500 000	2400
2.4	7.2	3
3	51	17
27	15	0.56
0.6	72	1220

Q	E	V
0.015	0.23	15.1
95.89	175 000	1825
785	3925	5
4.3	6.45	1.5
74	239	3.23
30	600	20

Electrical energy transferred

a. 24 J

b. 0.5 C

c. 200 000 V

E = V x Q

$$Q = \frac{E}{V}$$

$$V = \frac{E}{Q}$$

15	Q = I x t	Q	Charge	C
		I	Current	A
		t	Time	s

Q	I	t
	3	57
	13	60
180		18
0.6		36
160	0.4	
40	0.7	

Q	I	t
	0.015	107
	10.2	25.6
0.0155		0.0075
10.8		54.2
0.50	0.04	
560	3.2	

Click here for rearranged equation

A. **Calculate the charge carried by a current of 2.0A in 6.0s.**
B. **How long will it take a current of 10A to transfer 200C of charge?**
C. **What current flows from a mobile phone's battery if it transfers 300C per hour?**

15	Q = I x t	*Q*	Charge	C
		I	Current	A
		t	Time	s

Q	*I*	*t*
171	3	57
780	13	60
180	**10**	18
0.6	**0.017**	36
160	0.4	**400**
40	0.7	**57.14**

Q	*I*	*t*
1.61	0.015	107
261.12	10.2	25.6
0.0155	**2.07**	0.0075
10.8	**0.199**	54.2
0.50	0.04	**12.5**
560	3.2	**175**

Charge Flow

a. 12C

b. 20 s

c. 0.83 A

Q = I x t

$$I = \frac{Q}{T}$$

$$T = \frac{Q}{I}$$

16	V = I X R	*I*	Current	**A**
		V	Potential Difference	**V**
		R	Resistance	**Ω**

I	*V*	*R*
	9	3
	2	120
0.5		18
0.25		1.2
2	6	
3	18	

I	*V*	*R*
	230	17
	230	19 000
450		33
0.025		1300
0.05	350	
32	42 000	

Click here for rearranged equation

A. **Calculate the potential difference across a 3.0Ω resistor with 4.0A flowing through.**
B. **What is the resistance of a 230V lamp with 0.25A flowing in it?**
C. **A 4.7kΩ resistor is connected to a 1.5V cell. How much current flows?**

16	V = I X R	I	Current	A
		V	Potential Difference	V
		R	Resistance	Ω

I	V	R
3	9	3
0.017	2	120
0.5	9	18
0.25	0.3	1.2
2	6	3
3	18	6

I	V	R
13.5	230	17
0.012	230	19 000
450	14 850	33
0.025	32.5	1300
0.05	350	7000
32	42 000	1312.5

Ohm's Law

a. 12 V

b. 920 Ω

c. 0.0032 A (3.2×10^{-4} A)

$$V = I \times R$$

$$R = \frac{V}{I}$$

$$I = \frac{V}{R}$$

17	P = I x V	I	Current	A
		P	Electric Power	W
		V	Potential Difference	V

I	P	V
	9000	2
	55	0.5
4	9	
6	225	
1.4		3
0.2		1.25

I	P	V
	15000	250
	24 000	12
0.05	225	
850	17000	
6.1		230
1.2		5.13

Click here for rearranged equation

A. Calculate the power of a 230V lamp with 0.25A flowing in it.

B. What p.d. is needed across a 0.040W LED to cause a current of 0.020A?

C. A 3kW kettle is connected to the mains. How much current will flow?

17	P = I x V	*I*	Current	A
		P	Electric Power	W
		V	Potential Difference	V

I	*P*	*V*
4500	9000	2
110	55	0.5
4	9	**2.25**
6	225	**37.5**
1.4	**4.2**	3
0.2	**0.25**	1.25

I	*P*	*V*
60	15000	250
2000	24 000	12
0.05	225	**4500**
850	17000	**20**
6.1	**1403**	230
1.2	**6.16**	5.13

Electrical Power & P.D

a. **57.5 W**

b. **2 V**

c. **13.04 A**

$$P = I \times V$$

$$I = \frac{P}{V}$$

$$V = \frac{P}{I}$$

18	$P = I^2 \times R$	*I*	Current	A
		P	Electrical Power	W
		R	Resistance	Ω

I	*P*	*R*
	36	4
	6	24
0.8		15
0.4		2
2	1280	
4	53	

I	*P*	*R*
	2.4	60
	52.4	1000
0.21		260
0.004		33×10^6
3.2	4813	
0.89	375	

Click here for rearranged equation

A. **Calculate the power of a 16Ω resistor with 4.0A flowing through it.**
B. **What is the resistance of a 1200W heater when 3A flows?**
C. **How much current flows through a 2.0mW LED with a resistance of 0.50Ω?**

18	$P = I^2 \times R$	I	Current	A
		P	Electrical Power	W
		R	Resistance	Ω

I	P	R
3	36	4
0.5	6	24
0.8	**9.6**	15
0.4	**0.32**	2
2	1280	**320**
4	53	**3.31**

I	P	R
0.2	2.4	60
0.23	52.4	1000
0.21	**11.5**	260
0.004	**52 800**	33×10^6
3.2	4813	**470.02**
0.89	375	**4.73**

Electrical Power & Resistance

a. 256 W

b. 133.3 Ω

c. 0.2 A

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

$$R = \frac{P}{I^2}$$

$$I = \sqrt{\left(\frac{P}{R}\right)}$$

19	$\rho = \frac{m}{V}$	ρ	Density	**kg/m^3**
		m	Mass	**kg**
		V	Volume	**m^3**

ρ	m	V
	160	0.06
	10 000	0.5
3500		3.38
685		5.3
7700	60	
1900	0.0073	

ρ	m	V
	500	0.185
	0.5	4.1
11×10^3		0.032
1.2		3.5×10^5
2.1×10^9	8.4	
8.52×10^3	613	

Click here for rearranged equation

A. Calculate the density of a piece of metal, mass 3000kg and volume 0.70m³.

B. What is the volume of 65kg of air with a density of 1.1kg/m³?

C. What is the mass of 3.0cm³ of salt water if it has a density of 1 100kg/m³?

19	$p = \frac{m}{V}$	ρ	Density	kg/m³
		m	Mass	kg
		V	Volume	m^3

ρ	m	V
2 666.67	160	0.06
20 000	10 000	0.5
3500	**11 830**	3.38
685	**3630.5**	5.3
7700	60	**0.0078**
1900	0.0073	**3.84×10^{-6}**

ρ	m	V
2702.70	500	0.185
0.12	0.5	4.1
11×10^3	**343 750**	0.032
1.2	**3.4×10^{-6}**	3.5×10^5
2.1×10^9	8.4	**4×10^{-9}**
8.52×10^3	613	**0.072**

Density

a. 4.23×10^3 Kg/m³

b. 59.1 m³

c. 0.0033Kg

(3.3×10^{-3} Kg or 3.3g)

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

$$m = p \times V$$

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

20	F = k x e	e	Extension	m
		F	Force Exerted	N
		k	Spring Constant	N/m

e	F	k
	900	30
	0.5	40
		2.5
0.8		400
180	60	
0.25	10	

e	F	k
	820	0.04
	10.4	28
0.037		43
0.04		30
79	16 000	
3.4×10^{-3}	40	

Click here for rearranged equation

A. Calculate the force needed to extend a spring with a spring constant of 20N/m by 0.020m.

B. If a spring stretches by 0.020m when 26N is attached, what is the spring constant?

C. A car's suspension has *four* springs, *each* with a spring constant of 1.2×10^{5}N/m. By how much will the car sink when an 900N passenger gets into the car?

Force & Extension of a spring

a. 0.4 N

b. 130 N/m

c. 1.87×10^{-3} m (1.87 mm)

20	**F = k x e**	*e*	Extension	**m**
		F	Force Exerted	**N**
		k	Spring Constant	**N/m**

e	*F*	*k*
30	900	30
0.0125	0.5	40
3	**7.5**	2.5
0.8	**320**	400
180	60	**0.33**
0.25	10	**40**

e	*F*	*k*
20 500	820	0.04
0.37	10.4	28
0.037	**1.591**	43
0.04	**1.2**	30
79	16 000	**202.53**
3.4×10^{-3}	40	**11 764.71**

F = K x e

$$K = \frac{F}{e}$$

$$e = \frac{F}{k}$$

21	$P = \frac{F}{A}$	*A*	Area of Surface	m^2
		F	Force	N
		P	Pressure	Pa

A	*F*	*P*
	500 000	2400
	160	0.4
180		60
57		3
200	16000	
180	18	

A	*F*	*P*
	175 000	1825
	40	0.7
79		316
107		0.015
53	440	
36	0.6	

Click here for rearranged equation

A. **Calculate the pressure exerted by a brick weighing 56N and resting on an area of $0.02m^2$.**

B. **What is the area when a pressure of 75Pa is exerted by a force of 15N?**

C. **A drawing pin has a surface area of $0.10mm^2$ and exerts a pressure of 2GPa. What force is being applied to the pin?**

21	$P = \frac{F}{A}$	*A*	Area of Surface	m^2
		F	Force	**N**
		P	Pressure	**Pa**

A	*F*	*P*
208.33	500 000	2400
400	160	0.4
180	**10 800**	60
57	**171**	3
200	16000	**80**
180	18	**0.1**

A	*F*	*P*
95.89	175 000	1825
57.14	40	0.7
79	**24964**	316
107	**1.61**	0.015
53	440	**8.30**
36	0.6	**0.017**

Pressure

a. **2800 Pa**
b. **$0.2m^2$**
c. **200 N**

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

$$F = P \times A$$

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

22	$v^2 - u^2 = 2 \times a \times d$	a	Acceleration	**m/s²**
		d	Distance	**m**
		v	Final Velocity	**m/s**
		u	Start Velocity	**m/s**

a	d	v	u
	100	40	0
	45	15	3
7		5	2
1.3		10	6
1	250		20
1.6	1.2		0.8
4.5	8	11	
0.6	383	28	

Click here for rearranged equation

22	$v^2 - u^2 = 2 \times a \times d$	a	Acceleration	m/s^2
		d	Distance	m
		v	Final Velocity	m/s
		u	Start Velocity	m/s

a	d	v	u
800	100	40	0
2.4	45	15	3
7	1.5	5	2
1.3	24.62	10	6
1	250	900	20
1.6	1.2	4.35	0.8
4.5	8	11	7
0.6	383	28	18.01

$$v^2 - u^2 = 2 \times a \times d$$

$$\frac{v^2 - u^2}{2 \times a} = d$$

$$\frac{v^2 - u^2}{2 \times d} = a$$

$$v = \sqrt{[(2 \times a \times d) + u^2]}$$

$$u = \sqrt{[v^2 - (2 \times a \times d)]}$$

23	$$F = \frac{(mv - mu)}{t}$$	F	Force	**N**
		mv	Final Momentum	**m/s^2**
		mu	Start Momentum	**m/s^2**
		t	Time	**s**

F	mv	mu	t
	55	10	0.05
	31500	13500	20
40		130	0.5
0.78		70	18
95 500	68960		0.65
5100	38948		3
15	2150	344	
1.8	5.13	1.83	

Click here for rearranged equation

23	$$F = \frac{(mv - mu)}{t}$$	F	Force	**N**
		mv	Final Momentum	**m/s^2**
		mu	Start Momentum	**m/s^2**
		t	Time	**s**

F	mv	mu	t
900	55	10	0.05
900	31500	13500	20
40	**150**	130	0.5
0.78	**84.04**	70	18
95 500	68960	**6885**	0.65
5100	38948	**26 648**	3
15	2150	344	**120.4**
1.8	5.13	1.83	**1.83**

$$F = \frac{(mv - mu)}{T}$$

$$t = \frac{(mv - mu)}{F}$$

$$(F \times t) + mu = mv$$

$$mu = mv - (F \times t)$$

24	$E = V \times I \times t$	I	Current	**A**
		E	Energy	**J**
		V	Potential Difference	**V**
		t	Time	**s**

I	E	V	t
	0.6	240	10×10^{-6}
	54 300	11.9	1200
0.25		5	72×10^{3}
1.5		30	120
40×10^{-3}	8.6		180
2.55	195		17
50×10^{-3}	9.94×10^{5}	230	
3.5	1890	12	

Click here for rearranged equation

24	$E = V \times I \times t$	I	Current	A
		E	Energy	J
		V	Potential Difference	V
		t	Time	s

I	E	V	t
250	0.6	240	10×10^{-6}
3.80	54 300	11.9	1200
0.25	**90 000**	5	72×10^{3}
1.5	**5400**	30	120
40×10^{-3}	8.6	**4.78**	180
2.55	195	**4.49**	17
50×10^{-3}	9.94×10^{5}	230	**86 434.78**
3.5	1890	12	**45**

E = V x I x t

$$\frac{E}{V \times I} = t$$

$$\frac{E}{V \times t} = I$$

$$\frac{E}{t \times I} = V$$

25	$F = B \times I \times l$	I	Current	A
		F	Force on a Conductor in a Magnetic Field	N
		l	Length	m
		B	Magnetic Flux Density	N/Am

I	F	l	B
	18	7.1	0.19
	0.09	0.05	0.33
8.0		0.40	0.20
2.1		0.30	0.05
0.19	0.4		1.5
4.3	12		0.07
12	8.4	4.7	
5	0.024	0.06	

Click here for rearranged equation

25	$F = B \times I \times l$		
		I	Current	A
		F	Force on a Conductor in a Magnetic Field	N
		l	Length	m
		B	Magnetic Flux Density	N/Am

I	F	l	B
13.34	18	7.1	0.19
5.45	0.09	0.05	0.33
8.0	0.64	0.40	0.20
2.1	0.0315	0.30	0.05
0.19	0.4	1.40	1.5
4.3	12	39.87	0.07
12	8.4	4.7	0.15
5	0.024	0.06	0.08

$$F = B \times I \times l$$

$$l = \frac{F}{B \times I}$$

$$B = \frac{F}{l \times I}$$

$$I = \frac{F}{l \times B}$$

26	$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$		
		N_P	Number of Turns on the Primary Coil
		N_S	Number of Turns on the Secondary Coil
		V_P	Potential Difference in the Primary Coil
		V_S	Potential Difference in the Secondary Coil

V_p	V_s	N_p	N_s	Step-up or step-down?
100	300	20		
400 000	25 000	40		
230	7.2		18	
12	240		50	
120		1000	250	
24		450	150	
	28	180	50	
	62	4600	230	

Click here for rearranged equation

26	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$	N_P	Number of Turns on the Primary Coil
		N_S	Number of Turns on the Secondary Coil
		V_P	Potential Difference in the Primary Coil
		V_S	Potential Difference in the Secondary Coil

V_p	V_s	N_p	N_s	Step-up or step-down?
100	300	20	60	UP
400 000	25 000	40	2.5	DOWN
230	7.2	575	18	DOWN
12	240	2.5	50	UP
120	30	1000	250	DOWN
24	8	450	150	DOWN
100.8	28	180	50	DOWN
1240	62	4600	230	DOWN

$$\frac{Vs}{Vp} = \frac{Ns}{Np}$$

$$\frac{Vp}{Vs} = \frac{Np}{Ns}$$

$$Vp = \frac{Np}{Ns} \times Vs$$

$$Vs = \frac{Ns}{Np} \times Vp$$

$$Np = \frac{Vp}{Vs} \times Ns$$

$$Ns = \frac{Vs}{Vp} \times Np$$

27	$V_p \times I_p = V_s \times I_s$	I_P	Current in the Primary Coil	A
		I_S	Current in the Secondary Coil	A
		V_P	Potential Difference of the Primary Coil	V
		V_S	Potential Difference of the Secondary Coil	V

V_p	V_s	I_p	I_s	Step-up or step-down?
	1003	3.1	1.3	
	31	0.5	3.45	
922		0.15	2.1	
500	5		2	
110	230		4.1	
128000	230		5.0	
6	24	3		
30	40	20.0		

Click here for rearranged equation

27	$V_p \times I_p = V_s \times I_s$	I_P	Current in the Primary Coil	A
		I_S	Current in the Secondary Coil	A
		V_P	Potential Difference of the Primary Coil	V
		V_S	Potential Difference of the Secondary Coil	V

V_p	V_s	I_p	I_s	Step-up or step-down?
420.6	1003	3.1	1.3	**UP**
213.9	31	0.5	3.45	**DOWN**
922	**65.86**	0.15	2.1	**DOWN**
500	5	**0.02**	2	**DOWN**
110	230	**8.57**	4.1	**UP**
128000	230	**0.0089**	5.0	**DOWN**
6	24	3	**0.75**	**UP**
30	40	20.0	**15**	**UP**

Vp x Ip = Vs x Is

$$Vp = \frac{Vs \times Is}{Ip}$$

$$Ip = \frac{Vs \times Is}{Vp}$$

$$Vs = \frac{Vp \times Ip}{Is}$$

$$Is = \frac{Vp \times Ip}{Vs}$$

28	$E = m \times c \times \theta$	θ	Change in Temperature	**°C**
		E	Energy Transferred	**J**
		m	Mass	**kg**
		c	Specific Heat Capacity	**J/kg°C**

E	m	c	θ
	2	4200	80
	100	2100	50
7200		900	4
7200		390	4
1600	0.3		35
9 000 000	15		17
450 000	5.8	130	
198 000	8.9	850	

Click here for rearranged equation

28	$E = m \times c \times \theta$	θ	Change in Temperature	**°C**
		E	Energy Transferred	**J**
		m	Mass	**kg**
		c	Specific Heat Capacity	**J/kg°C**

E	m	c	θ
672 000	2	4200	80
10 500 000	100	2100	50
7200	**2**	900	4
7200	**4.62**	390	4
1600	0.3	**152.38**	35
9 000 000	15	**35 294.12**	17
450 000	5.8	130	**596.83**
198 000	8.9	850	**26.17**

E = m x c x ϴ

$$\frac{E}{c \times \theta} = m$$

$$\frac{E}{m \times \theta} = c$$

$$\frac{E}{c \times m} = \theta$$

29	$E = m \times L$	E	Energy Transferred	**J**
		m	Mass	**kg**
		L	Specific Latent Heat	**J/kg**

E	m	L
	70	1400
	5	334×10^3
80		500
195 800		1100
634 000	2.3	
950	0.38	

E	m	L
	0.018	2.3×10^6
	0.82	3.3×10^5
512		8540
115 000		22.6×10^3
756	0.03	
1.05×10^7	167	

Click here for rearranged equation

29	$E = m \times L$	E	Energy Transferred	**J**
		m	Mass	**kg**
		L	Specific Latent Heat	**J/kg**

E	m	L	E	m	L
98 000	70	1400	**41 400**	0.018	2.3×10^6
1 670 000	5	334×10^3	**270 600**	0.82	3.3×10^5
80	**0.16**	500	512	**0.06**	8540
195 800	**178**	1100	115 000	**5.88**	22.6×10^3
634 000	2.3	**275 652.17**	756	0.03	**25 200**
950	0.38	**2500**	1.05×10^7	167	**62 874.25**

E = m x L

$$\frac{E}{L} = m$$

$$\frac{E}{m} = L$$

30	$P_1 \times V_1 = P_2 \times V_2$	P_1	Pressure (Start)	**Pa**
		P_2	Pressure (End)	**Pa**
		V_1	Volume (Start)	**m^3**
		V_2	Volume (End)	**m^3**

P_1	V_1	P_2	V_2
24	600	96	
62.8	50	1000	
3.5	90		10.5
104	5.5		5.9
1200		325	25
14 000		10 000	15
	20	4×10^5	5
	8×10^{-4}	101×10^3	2×10^{-4}

Click here for rearranged equation

30	$P_1 \times V_1 = P_2 \times V_2$	P_1	Pressure (Start)	**Pa**
		P_2	Pressure (End)	**Pa**
		V_1	Volume (Start)	**m^3**
		V_2	Volume (End)	**m^3**

P_1	V_1	P_2	V_2
24	600	96	**150**
62.8	50	1000	**3.14**
3.5	90	**30**	10.5
104	5.5	**96.95**	5.9
1200	**6.77**	325	25
14 000	**10.71**	10 000	15
100 000	20	4×10^5	5
25 250	8×10^{-4}	101×10^3	2×10^{-4}

P1 x V1 = P2 x V2

P1 = $\frac{P2 \times V2}{V1}$

V1 = $\frac{P2 \times V2}{P1}$

P2 = $\frac{P1 \times V1}{V2}$

V2 = $\frac{P1 \times V1}{P2}$

31	$E = \frac{1}{2} \times k \times e^2$	E	Energy Transferred	**J**
		e	Extension	**m**
		k	Spring Constant	**N/m**

E	e	k
	5	380
	0.015	30 000
320		160
35		1100
250	0.1	
0.3	0.2	

E	e	k
	0.12	53.6
	0.032	0.032
3800		90
17.3		15 600
67 000	7.4	
265	3.8×10^{-3}	

Click here for rearranged equation

31	$E = \frac{1}{2} \times k \times e^2$	E	Energy Transferred	J
		e	Extension	m
		k	Spring Constant	N/m

E	e	k		E	e	k
4750	5	380		**0.39**	0.12	53.6
3.38	0.015	30 000		**1.64×10^{-5}**	0.032	0.032
320	**2**	160		3800	**9.19**	90
35	**0.25**	1100		17.3	**0.047**	15 600
250	0.1	**50 000**		67 000	7.4	**2447.04**
0.3	0.2	**15**		265	3.8×10^{-3}	**36 703 601.1**

$$E = \frac{1}{2} \times k \times e^2$$

$$e = \sqrt{\left(\frac{E}{0.5 \times k}\right)}$$

$$K = 2 \times \left(\frac{E}{e^2}\right)$$

32	$p = h \times \rho \times g$	ρ	Density of Liquid	**kg/m^3**
		g	Gravitational Field Strength	**N/kg**
		h	Height of Column	**m**
		p	Pressure due to a Column of Liquid	**Pa**

ρ	h	p
900	0.20	
900	0.40	
900	0.60	
400	5	
500	5	
700	5	

ρ	h	p
	1.6	11 200
	3.2	38 400
	0.07	437
1030		773 000
820		205 000
13500		4050

Click here for rearranged equation

These calculations taken place on Earth where g =10

32	$p = h \times \rho \times g$	ρ	Density of Liquid	**kg/m^3**
		g	Gravitational Field Strength	**N/kg**
		h	Height of Column	**m**
		p	Pressure due to a Column of Liquid	**Pa**

ρ	h	p
900	0.20	**1800**
900	0.40	**3600**
900	0.60	**5400**
400	5	**20 000**
500	5	**25 000**
700	5	**35 000**

ρ	h	p
700	1.6	11 200
1200	3.2	38 400
624.29	0.07	437
1030	**75.05**	773 000
820	**25**	205 000
13500	**0.03**	4050

p = h x *ρ* x g

g = $\frac{p}{h \times \rho}$

h = $\frac{p}{g \times \rho}$

***ρ* = $\frac{p}{h \times g}$**

These calculations taken place on Earth where g =10

GCSE Physics Calculations Practice (Grade 4)

1. **If a force of 13N is applied over a distance of 71m, how much work is done?**

2. **A frog covers 17metres in 34 seconds, what is its speed?**

3. **If a circuit has a potential difference of 6V and a current of 4A what is the circuit's resistance?**

4. **If the force applied to a spring is 300N and the spring extends by 2metres, what is the spring constant?**

5. **A 200W toaster takes 2 minutes to toast some bread. How much energy was used?**

6. **A 2kg box was lifted onto a 3metre shelf (g =10N/kg) how much Gravitational potential energy has it gained?**

GCSE Physics Calculations Practice (Grade 4)

1. **If a force of 13N is applied over a distance of 71m, how much work is done?** **923 J**
2. **A frog covers 17metres in 34 seconds, what is its speed?** **0.5 m/s**
3. **If a circuit has a potential difference of 6V and a current of 4A what is the circuit's resistance?**

   1.5 Ω
4. **If the force applied to a spring is 300N and the spring extends by 2metres, what is the spring constant?**

   1500 N/m
5. **A 200W toaster takes 2 minutes to toast some bread. How much energy was used?** **2.4×10^5 J**
6. **A 2kg box was lifted onto a 3metre shelf (g =10N/kg) how much Gravitational potential energy has it gained?**

   60 J

7. **A 110kg rugby player runs at a velocity of 6 metres per second, what is his momentum?**

8. **A 12kg dog has an acceleration of $2m/s^2$, how much force was needed for this acceleration?**

9. **Usain Bolt has a mass of 90kg and runs at a velocity of 11m/s, what is his kinetic energy?**

10. **A washing machine uses a 3A current and runs on a potential difference of 230V, what is the power rating of the machine?**

11. **A lorry of mass 20 000kg produces a force of 30kN, calculate the acceleration.**

12. **A Bugatti covers 32km in 20minutes, what is its speed in a) m/s b) km/h?**

13. **How much does a 71kg girl weigh on the moon? (g=1.kN/kg)**

14. **A cricket ball of mass 200g travels at 20m/s, what is it's a) momentum b) kinetic energy?**

15. **How much work must be done to push a 1750kg car back home, a distance of 3.4km?**

7. A 110kg rugby player runs at a velocity of 6 metres per second, what is his momentum? 660 Kg m/s

8. A 12kg dog has an acceleration of $2 m/s^2$, how much force was needed for this acceleration? 24 N

9. Usain Bolt has a mass of 90kg and runs at a velocity of 11m/s, what is his kinetic energy? 5445 J

10. A washing machine uses a 3A current and runs on a potential difference of 230V, what is the power rating of the machin 690 W

11. A lorry of mass 20 000kg produces a force of 30kN, calculate the acceleration. $1.5 m/s^2$

12. A Bugatti covers 32km in 20minutes, what is its speed in a) m/s b) km/h? 19.17 m/s 69.69 km/hr

13. How much does a 71kg girl weigh on the moon? (g=1.kN/kg) 7.1×10^4 N

14. A cricket ball of mass 200g travels at 20m/s, what is it's a) momentum b) kinetic energy? 4 kg m/s 40 J

15. How much work must be done to push a 1750kg car back home, a distance of 3.4km? 5.831×10^4 KJ

GCSE Physics Calculations Practice (Grade 6+)

1. If a force of 71 N is applied over a distance of 110m, how much work is done?
2. A frog covers 0.5 km in 25 seconds, what is its speed?
3. If a circuit has a potential difference of 6kV and a current of 400mA what is the circuit's resistance?
4. If the force applied to a spring is 316MN and the spring extends by 0.2metres, what is the spring constant?
5. A 0.34kW toaster takes 21 seconds to toast some bread. How much energy was used?
6. A 2g box was lifted onto a 300mm shelf (g =10N/kg) how much Gravitational potential energy has it gained?
7. A 150 000g rugby player runs at a velocity of 10km/h, what is his momentum?
8. A 15 000 000 mg dog has an acceleration of 4.5 m/s^2, how much force was needed for this acceleration?
9. Usain Bolt has a mass of 90kg and runs at a velocity of 30km/h, what is his kinetic energy?
10. A washing machine uses a 6000 mA current and runs on a potential difference of 0.4kV, what is the power rating of the machine?

GCSE Physics Calculations Practice (Grade 6+)

7810 J

1. If a force of 71 N is applied over a distance of 110m, how much work is done?
2. A frog covers 0.5 km in 25 seconds, what is its speed? 20 m/s

15000 Ω

3. If a circuit has a potential difference of 6kV and a current of 400mA what is the circuit's resistance?

1.58×10^9 N/m

4. If the force applied to a spring is 316MN and the spring extends by 0.2metres, what is the spring constant?
5. A 0.34kW toaster takes 21 seconds to toast some bread. How much energy was used? 7.14 KJ
6. A 2g box was lifted onto a 300mm shelf (g =10N/kg) how much Gravitational potential energy has it g

0.006 J

7. A 150 000g rugby player runs at a velocity of 10km/h, what is his momentum? 417 Kg m/S
8. A 15 000 000 mg dog has an acceleration of 4.5 m/s^2, how much force was needed for this acceleration?

6.75×10^4 N

9. Usain Bolt has a mass of 90kg and runs at a velocity of 30km/h, what is his kinetic energy?

374.85J

10. A washing machine uses a 6000 mA current and runs on a potential difference of 0.4kV, what is the power rating of the machine? 2400 W

A car produces a driving force of 2000N. It experiences friction force from the ground of 500N and air resistance of 300N. what is the resultant force?	What equation links mass, force and acceleration?	A car of mass 400kg is accelerating at $5m/s^2$. What is the driving force produced by the engine?	A man pushes a car with a force of 200N along a straight horizontal road. He manages to accelerate the car by $0.1m/s^2$. Find the mass of the car.
A car accelerates from a velocity of 10m/s to a velocity of 25m/s in 15 seconds. What is the acceleration of the car?	What equation links change in velocity, time and acceleration?	A runner starts at rest and accelerates to a top speed of 10m/s. If he does this in 2 seconds, what is his acceleration?	What equation links weight, mass and gravitational field strength?

A car produces a driving force of 2000N. It experiences friction force from the ground of 500N and air resistance of 300N. what is the resultant force? **1200 N**	What equation links mass, force and acceleration? **F = m x a**	A car of mass 400kg is accelerating at $5m/s^2$. What is the driving force produced by the engine? **2000 N**	A man pushes a car with a force of 200N along a straight horizontal road. He manages to accelerate the car by $0.1m/s^2$. Find the mass of the car. **2000 kg**
A car accelerates from a velocity of 10m/s to a velocity of 25m/s in 15 seconds. What is the acceleration of the car? **$1\ m/s^2$**	What equation links change in velocity, time and acceleration? $a = \frac{\Delta V}{t}$	A runner starts at rest and accelerates to a top speed of 10m/s. If he does this in 2 seconds, what is his acceleration? **$5\ m/s^2$**	What equation links weight, mass and gravitational field strength? **W = m x g**

Calculate the weight of car of mass 400kg on earth.	**The gfs of Jupiter is 13N/Kg. What is the difference in weight between a man of 56kg on earth compared to Jupiter.?**	**An object of weight 40N is raised by a height of 0.4m. Calculate the work done in raising the object.**	**2000J of energy is transferred by a sprinter as he runs a distance of 100m. Calculate the force that is exerted by the sprinter as he is running.**
What equation links power, energy and time?	**400J of energy is transferred in raising an object in 1 minute. What is the power?**	**A car engine transfers 3000J in 20 seconds. What is the power generated by the engine?**	**A student of weight 500N transfers 2000J whilst running up some stairs. She reaches the top of the stairs in 3 seconds. How high are the stairs and what is her power?**

Calculate the weight of car of mass 400kg on earth. **3920 N**	The gfs of Jupiter is 13N/Kg. What is the difference in weight between a man of 56kg on earth compared to Jupiter.? **179.2 N**	An object of weight 40N is raised by a height of 0.4m. Calculate the work done in raising the object. **16 J**	2000J of energy is transferred by a sprinter as he runs a distance of 100m. Calculate the force that is exerted by the sprinter as he is running. **200 N**
What equation links power, energy and time? $P = \frac{E}{t}$	400J of energy is transferred in raising an object in 1 minute. What is the power? **6.67 W**	A car engine transfers 3000J in 20 seconds. What is the power generated by the engine? **150 W**	A student of weight 500N transfers 2000J whilst running up some stairs. She reaches the top of the stairs in 3 seconds. How high are the stairs and what is her power? **4 m**