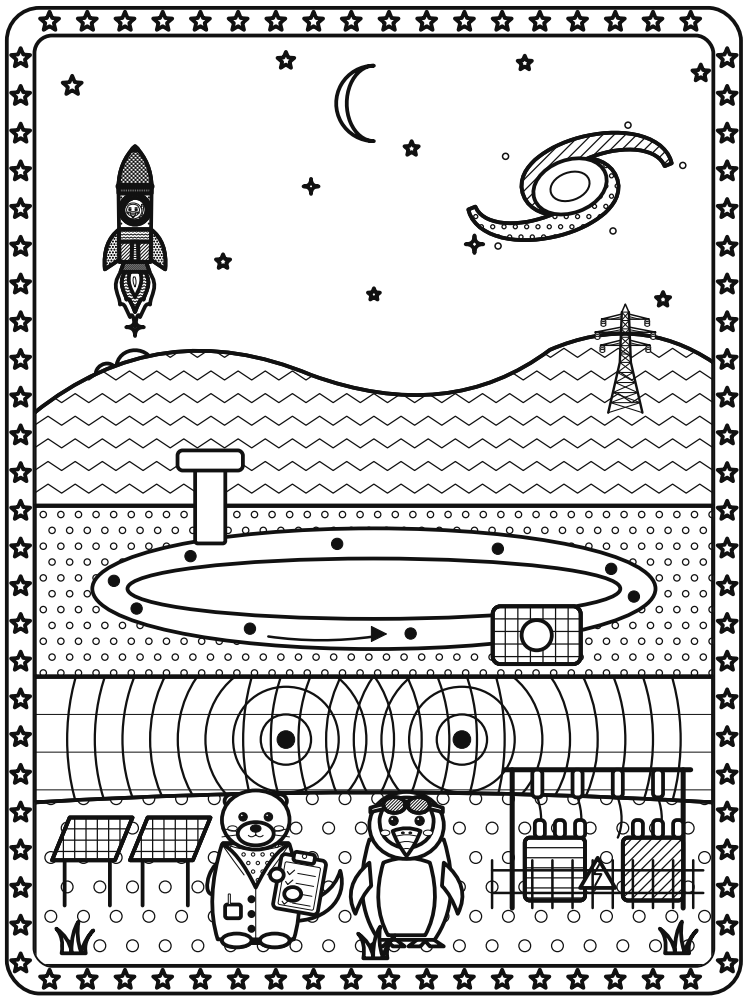
REAL-LIFE PHYSICS

Higher Physics

Revision Guide

Notes, worked examples, exam-style questions and two practice papers, with full answers



C. Blewis

Blewis LEARNING

Contents

GETTING STARTED		
	How to use this guide	4
	The exam	5
	Exam skills	6
	Relationships	9
OUR DYNAMIC UNIVERSE		
1.1	Motion: equations and graphs	12
1.2	Forces, energy and power	16
1.3	Collisions, explosions and impulse	21
1.4	Gravitation	25
1.5	Special relativity	28
1.6	The expanding Universe	31
PARTICLES AND WAVES		
2.1	Forces on charged particles	36
2.2	The Standard Model	40
2.3	Nuclear reactions	43
2.4	Inverse square law	46
2.5	Wave–particle duality	49
2.6	Interference	52
2.7	Spectra	55
2.8	Refraction of light	58
ELECTRICITY		
3.1	Monitoring and measuring a.c.	62
3.2	Current, p.d., power and resistance	65
3.3	Electrical sources and internal resistance	68
3.4	Capacitors	71
3.5	Semiconductors and p–n junctions	74
PRACTICE AND ANSWERS		
	Practice paper 1	77
	Practice paper 2	91
	Answers	104
	Practice paper marking	117

How to use this guide

This guide covers the whole Higher Physics course in three areas. Each key area follows the same pattern, so you always know what comes next.

EACH KEY AREA HAS

Notes	the ideas you need, in short sections with diagrams
Relationships	each one with its symbols and units, and a worked example set out step by step
Exam tips	common mistakes and how to pick up every mark
Quick check	short questions to test yourself straight away
Exam-style questions	longer questions with marks, like the real exam

A GOOD WAY TO REVISE

1. Read the notes and cover the worked example. Can you do it yourself?
2. Try the quick check without looking back. Mark it using the answers at the back.
3. Do the exam-style questions in your jotter, with full working. Then mark them carefully against the marking guidance.
4. Tick the key area off on the tracker at the start of each area: **1** need more work, **2** getting there, **3** confident.
5. When you have revised everything, sit the practice papers under exam conditions.

ANSWERS

All answers are at the back. For exam-style questions the marking guidance shows where each mark comes from, so you can see exactly what examiners look for.

CHECK THE COURSE

Exam arrangements and course content can change. Your teacher and the latest course documents always come first.

The exam

Higher Physics is assessed by a question paper and an assignment. This is the current format. **Arrangements can change, so check the latest arrangements with your teacher.** Past papers from before session 2026–27 used a different, longer format, so allow for this if you use them for practice. On the day, allow a little over one minute per mark, show all your working, and never leave a multiple choice answer blank.

	What it is	Marks
Question paper	One paper, 2 hours 30 minutes. A data sheet and a relationships sheet are provided.	130
Section 1	Objective test: multiple choice questions (choose A to E).	20
Section 2	Restricted and extended response questions: calculations, explanations, graphs, experiments, uncertainties and open-ended questions.	110
Assignment	A report on an experiment you carry out, with data from another source. The report stage is written under supervision and lasts up to 2 hours.	20 (scaled to 33)

Command words

Command word	What you need to do
State, name, give	a short answer, no explanation needed
Describe	say what happens or what something is like; give the steps or features
Explain	say **why** or **how**, using physics; link cause to effect
Calculate	use a relationship: show the relationship, substitution and answer with unit
Determine	find the value, often from a graph, a table or several steps
Estimate	find an approximate value, e.g. from a graph or a sensible assumption
Suggest	there may be more than one answer; use physics to give a sensible one
Predict	say what will happen, using a pattern, a graph or a relationship
Show that	prove the given value; every step must be shown, including the final value
Sketch	a graph or diagram showing the general shape and key features; no exact scale needed
Using your knowledge of physics	an open-ended question: there is no single correct answer, so show your understanding

Exam skills

Units and prefixes

Use **SI units** in relationships: metres, kilograms, seconds, amperes, kelvin. Change prefixes **before** you substitute.

Prefix	Symbol	Means	Example
pico	p	$\times 10^{-12}$	470 pF = 4.70×10^{-10} F
nano	n	$\times 10^{-9}$	589 nm = 5.89×10^{-7} m
micro	μ	$\times 10^{-6}$	220 μF = 2.20×10^{-4} F
milli	m	$\times 10^{-3}$	15 mA = 1.5×10^{-2} A
kilo	k	$\times 10^{3}$	4.7 kΩ = 4.7×10^{3} Ω
mega	M	$\times 10^{6}$	2.0 MeV energy, 5.0 MHz
giga	G	$\times 10^{9}$	1.2 GW = 1.2×10^{9} W
tera	T	$\times 10^{12}$	6.0×10^{14} Hz = 600 THz

Scientific notation and significant figures

Write very large and very small numbers as a number between 1 and 10 times a power of ten: 0.000 000 589 m = 5.89×10^{-7} m. Use the **×10^{x}** (or EXP) key on your calculator. Give your final answer to the same number of significant figures as the least precise data. Markers usually accept from one fewer to two more significant figures than this, but check the current marking instructions. Keep full values in your calculator until the end.

The three-step method

WORKED EXAMPLE

A 1200 kg car accelerates from 8.0 m/s to 20.0 m/s in 6.0 s. Calculate the unbalanced force on it.

Relationships $a = (v - u) / t$ and $F = m\,a$

Substitute $a = \dfrac{20.0 - 8.0}{6.0} = 2.0$ m/s²; $F = 1200 \times 2.0$

Answer **F = 2400 N**

HOW THE MARKS ARE GIVEN

- Usually **1 mark** for the relationship, **1 mark** for the correct substitution and **1 mark** for the final answer with its unit.
- In a two-step calculation, a value from the first step can be carried forward.
- A wrong or missing unit loses the final mark.

Rearranging

Do the same thing to both sides. To find r from $F = G\,m_1\,m_2 \div r^2$, multiply both sides by r^2, divide by F, then take the square root: $r = \sqrt{(G\,m_1\,m_2 \div F)}$.

1.1 Motion: equations and graphs

When an object moves in a straight line with **constant acceleration**, five quantities describe its motion: displacement s, initial velocity u, final velocity v, acceleration a and time t. Each equation of motion links four of them, so if you know three you can find the others.

EQUATIONS OF MOTION

$$v = u + at$$
$$s = ut + \tfrac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$
$$s = \tfrac{1}{2}(u + v)t$$

s	displacement in metres (m)
u	initial velocity in m/s
v	final velocity in m/s
a	acceleration in m/s²
t	time in seconds (s)

KEY POINTS

- Choose a direction as **positive** (usually up, or the direction of motion) and stick to it. Velocities and accelerations the other way are **negative**.
- Something thrown upwards has a = −9.8 m/s² all the way up and all the way down; at the top v = 0 but a is still −9.8 m/s².
- List s, u, v, a, t, mark the one you want and the one you don't need, then pick the equation without the unwanted one.

WORKED EXAMPLE 1

A car accelerates uniformly from 8.0 m/s to 20.0 m/s over 140 m. Find its acceleration.

Relationship	$v^2 = u^2 + 2as$
Substitute	$20.0^2 = 8.0^2 + 2 \times a \times 140$
Answer	**$a = 1.2$ m/s²**

WORKED EXAMPLE 2

A ball is thrown straight up at 12.0 m/s. Find its maximum height.

Values	u = 12.0 m/s, v = 0, a = −9.8 m/s²
Relationship	$v^2 = u^2 + 2as$
Substitute	$0 = 12.0^2 + 2 \times (-9.8) \times s$
Answer	$s = \frac{144}{19.6} =$ **7.3 m**

EXAM TIP

Write the list of s, u, v, a, t first, with signs. Most errors come from a missing minus sign on g for something moving upwards.

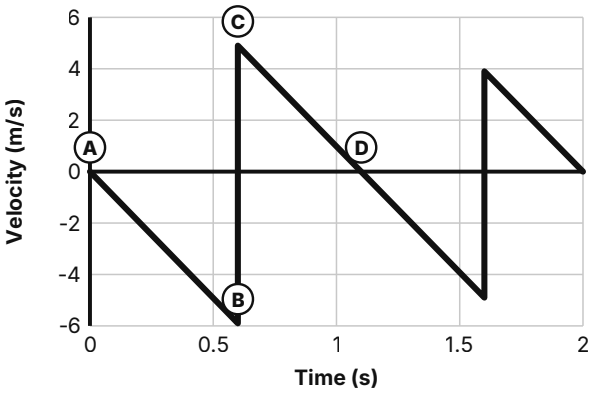
1.1 Motion: equations and graphs

How the three motion graphs are linked

Graph	Gradient gives	Area under the line gives
displacement–time	velocity	(not used)
velocity–time	acceleration	displacement (change in)
acceleration–time	(not used)	change in velocity

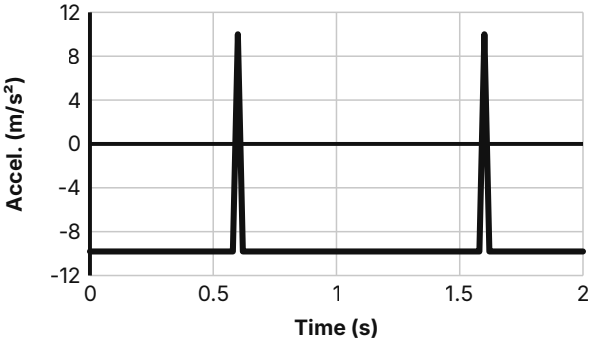
A bouncing ball

A ball is dropped from rest and bounces twice. Upwards is positive. Between bounces the only force is its weight, so the gradient of the velocity–time graph is always −9.8 m/s². At each bounce the velocity changes from negative to positive almost instantly.

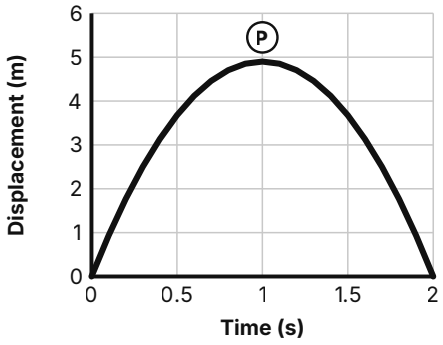


KEY POINTS

- **A to B:** falling, speeding up downwards (velocity negative).
- **B to C:** the bounce. The velocity reverses almost instantly; the ball leaves the ground slower than it hit it, because energy is lost.
- **C to D:** rising, slowing down; at D it is at the top and momentarily at rest.
- Each straight section has the same gradient, −9.8 m/s² (−g).



Acceleration–time graph for the same ball



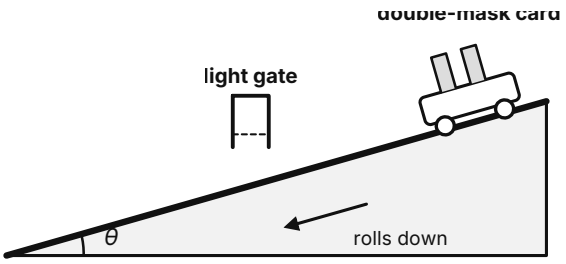
A ball thrown up: displacement–time is a curve; at P the gradient is zero, so v = 0

EXAM TIP

When you sketch a v–t graph for something thrown upwards, the line crosses the time axis at the top of the flight and keeps the same gradient. Do not draw a V shape.

1.1 Motion: equations and graphs

Finding acceleration by experiment



EXPERIMENT: ACCELERATION DOWN A SLOPE

A trolley with a **double-mask card** rolls down a slope through one light gate. The timer records the time to pass each mask and the time between them. Speed through each mask = mask length ÷ time, then $a = \frac{v - u}{t}$. Repeat at least three times and find the mean. Changing the slope angle θ and plotting a against sin θ gives a straight line: the gradient is close to g, and the line falls a little below the origin because of friction.

WORKED EXAMPLE

Each mask of a double-mask card is 0.050 m long. The times through the masks are 0.125 s and 0.080 s, and the time between the masks is 0.30 s. Find the acceleration.

Speeds $u = \frac{0.050}{0.125} = 0.40$ m/s; $v = \frac{0.050}{0.080} = 0.625$ m/s

Relationship $a = \frac{v - u}{t}$

Substitute $a = \frac{0.625 - 0.40}{0.30}$

Answer **$a = 0.75$ m/s²**

EXAM TIP

Higher questions often ask you to **describe** this experiment. Name the apparatus, say exactly what is measured, and say how the acceleration is calculated from the measurements.

Quick check

1. A cyclist slows uniformly from 9.0 m/s to 3.0 m/s in 4.0 s. Find the deceleration and the distance travelled.
2. A stone is dropped from rest down a well and hits the water after 1.8 s. How deep is the well?
3. What does the area under an acceleration–time graph represent?
4. A ball is thrown up at 6.0 m/s. How long does it take to reach its highest point?
5. Sketch the acceleration–time graph for a ball thrown up and caught again at the same height.
6. A trolley's acceleration on a slope is measured at five angles. What graph should be drawn to show that a is proportional to sin θ?

1.1 Motion: equations and graphs

Exam-style questions (19 marks)

1 A train leaves a station and accelerates uniformly from 4.0 m/s to 22.0 m/s over a distance of 480 m.

(a) Calculate the acceleration of the train. **(3)**

(b) Calculate the time taken. **(3)**

2 A ball is thrown vertically upwards from a player's hand at 14.7 m/s. Air resistance can be ignored.

(a) Calculate the time taken for the ball to reach its maximum height. **(3)**

(b) Calculate the maximum height reached above the hand. **(3)**

(c) Sketch a graph of the ball's velocity against time from leaving the hand until it is caught again at the same height. Numerical values are required on both axes. **(2)**

3 Isla measures the acceleration of a trolley released at different angles on a slope. Her results are shown below.

sin θ	0.05	0.10	0.15	0.20	0.25
a (m/s²)	0.45	0.94	1.43	1.92	2.41

(a) State the measurements Isla must take with a double-mask card and one light gate to find each acceleration. **(2)**

(b) Use the results to determine the gradient of a graph of acceleration against sin θ. **(2)**

(c) The line of best fit does not pass through the origin. Suggest a reason for this. **(1)**

> **EXAM TIP**
> For a gradient, use two points far apart on your line of best fit, not two data points close together.

FREE SAMPLE

Higher Physics Revision Guide

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