STEM SMART Phase One, 2022

Physics Week 4 – Accelerated Motion

https://isaacphysics.org/gameboards#smart_p_1_4

Essential Pre-Uni Physics B3.9

GCSE - Practice (P3)
A Level - Practice (P1)

Assume that any dropped or thrown object accelerates downwards at $9.8\,\mathrm{m\,s^{-2}}$. If a question says that an object is 'dropped' this means that its velocity is zero at the beginning of the motion.

Please give your answers to 2 significant figures. If asked for a velocity or displacement, your answer MUST contain a direction in order to be marked as correct. Take the positive direction to be upwards.

You want to fire a ball vertically into the air so that it goes $100\,\mathrm{m}$ up before coming back down again (its maximum height is $100\,\mathrm{m}$). How fast should you fire it?

Essential GCSE Physics 11.1

GCSE - Practice (P1)
A Level - Practice (P1)

Complete the table with the correct values. Each row represents a separate situation.

Acceleration ($\mathrm{m/s^2}$)	**Velocity ($\mathrm{m/s}$) after ... s**						
	0.0	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**
3.0	0.0	3.0	(a)	9.0	(b)	(c)	18
5.0	0.0			(d)		(e)	(f)
7.0	3.0			(g)	(h)		(i)
-25.0	30.0			(j)	(k)		(l)
(m)	10.5		13.5		(n)		
(o)	45		36		27		(p)

Part A **Velocity (a)**

What is the velocity of an object accelerating at $3.0\,\mathrm{m/s^2}$ after $2.0\,\mathrm{s}$ having started from rest?

Part B **Velocity (b)**

What is the velocity of an object accelerating at $3.0\,\mathrm{m/s^2}$ after $4.0\,\mathrm{s}$ having started from rest?

Part C **Velocity (c)**

What is the velocity of an object accelerating at $3.0\,\mathrm{m/s^2}$ after $5.0\,\mathrm{s}$ having started from rest?

Part D **Velocity (d)**

What is the velocity of an object accelerating at $5.0\,\mathrm{m/s^2}$ after $3.0\,\mathrm{s}$ having started from rest?

Part E **Velocity (e)**

What is the velocity of an object accelerating at $5.0\,\mathrm{m/s^2}$ after $5.0\,\mathrm{s}$ having started from rest?

Part F **Velocity (f)**

What is the velocity of an object accelerating at $5.0\,\mathrm{m/s^2}$ after $6.0\,\mathrm{s}$ having started from rest?

Part G **Velocity (g)**

What is the velocity of an object accelerating at $7.0\,\mathrm{m/s^2}$ after $3.0\,\mathrm{s}$ when it is initially moving at $3.0\,\mathrm{m/s}$?

Part H **Velocity (h)**

What is the velocity of an object accelerating at $7.0\,\mathrm{m/s^2}$ after $4.0\,\mathrm{s}$ when it is initially moving at $3.0\,\mathrm{m/s}$?

Part I **Velocity (i)**

What is the velocity of an object accelerating at $7.0\,\mathrm{m/s^2}$ after $6.0\,\mathrm{s}$ when it is initially moving at $3.0\,\mathrm{m/s}$?

Part J **Velocity (j)**

What is the velocity of an object accelerating at $-25.0\,\mathrm{m/s^2}$ after $3.0\,\mathrm{s}$ when it is initially moving at $30.0\,\mathrm{m/s}$?

Part K **Velocity (k)**

What is the velocity of an object accelerating at $-25.0\,\mathrm{m/s^2}$ after $4.0\,\mathrm{s}$ when it is initially moving at $30.0\,\mathrm{m/s}$?

Part L **Velocity (l)**

What is the velocity of an object accelerating at $-25.0\,\mathrm{m/s^2}$ after $6.0\,\mathrm{s}$ when it is initially moving at $30.0\,\mathrm{m/s}$?

Part M **Acceleration (m)**

What is the acceleration of an object that is initially moving at $10.5\,\mathrm{m/s}$ and is moving at $13.5\,\mathrm{m/s}$ after $2.0\,\mathrm{s}$?

Part N **Velocity (n)**

What velocity is an object moving at after $4.0\,\mathrm{s}$ if it is initially moving at $10.5\,\mathrm{m/s}$ and is moving at $13.5\,\mathrm{m/s}$ after $2.0\,\mathrm{s}$?

Part O **Acceleration (o)**

What is the acceleration of an object that is moving at $45\,\mathrm{m/s}$ initially, $36\,\mathrm{m/s}$ after $2.0\,\mathrm{s}$ and $27\,\mathrm{m/s}$ after $4.0\,\mathrm{s}$?

Part P **Velocity (p)**

What velocity is an object moving at after $6.0\,\mathrm{s}$ if it is moving at $45\,\mathrm{m/s}$ initially, $36\,\mathrm{m/s}$ after $2.0\,\mathrm{s}$ and $27\,\mathrm{m/s}$ after $4.0\,\mathrm{s}$?

Essential GCSE Physics 11.2

GCSE - Practice (P1)
A Level - Practice (P1)

In 11.1d, what would the velocity be $15\,\mathrm{s}$ after the start if the acceleration were maintained?

What is the velocity of an object accelerating at $5.0\,\mathrm{m/s^2}$ after $15\,\mathrm{s}$ having started from rest?

Essential GCSE Physics 11.3

GCSE - Practice (P1)
A Level - Practice (P1)

In Q11.1o, at what time does the vehicle come to a stop?

If a vehicle is moving at $45\,\mathrm{m/s}$ initially, $36\,\mathrm{m/s}$ after $2.0\,\mathrm{s}$ and $27\,\mathrm{m/s}$ after $4.0\,\mathrm{s}$, at what time will it come to a stop?

Essential GCSE Physics 11.4

GCSE - Practice (P1)
A Level - Practice (P1)

A tennis ball is thrown in the air upwards at $15\,\mathrm{m/s}$. If it is accelerating downwards at $10\,\mathrm{m/s^2}$, what will its velocity be $2.0\,\mathrm{s}$ after it is thrown? Let downwards vectors be positive and upwards negative.

Essential GCSE Physics 21.2

GCSE - Practice (P3)
A Level - Practice (P1)

A $£5$ note is $135\,\mathrm{mm}$ long. A friend has a crisp $£5$ note, and holds the bottom of the note in line with (and between) your thumb and index finger. She drops it, and if you grab it without moving your hand downwards, you are allowed to keep it.

How quickly do you have to react to win your prize?

Essential GCSE Physics 21.3

GCSE - Practice (P3)
A Level - Practice (P1)

The Highway Code assumes that a car with its brakes on fully has an acceleration of $-6.7\,\mathrm{m/s^2}$.

Part A $30\,\mathrm{mph}$ stopping time

Calculate the time taken to stop a car from $30\,\mathrm{mph}$ ($13.4\,\mathrm{m/s}$).

Part B $30\,\mathrm{mph}$ stopping distance

Calculate the distance taken to stop a car at $30\,\mathrm{mph}$ ($13.4\,\mathrm{m/s}$).

Part C $70\,\mathrm{mph}$ stopping time

Calculate the time taken to stop a car from $70\,\mathrm{mph}$ ($31\,\mathrm{m/s}$).

Part D $70\,\mathrm{mph}$ stopping distance

Calculate the distance taken to stop a car from $70\,\mathrm{mph}$ ($31\,\mathrm{m/s}$).

Essential GCSE Physics 21.4

GCSE - Practice (P3)
A Level - Practice (P1)

You throw a cricket ball up into the air at $10\,\mathrm{m/s}$.

[Hint: if you take $u = 10\,\mathrm{m/s}$ then $a = -10\,\mathrm{m/s^2}$ as the acceleration is in the opposite direction to the initial velocity.]

Part A Time elapsed

How much time elapses before it reaches the highest point of its motion?

[Hint: at the top, $v = 0$.]

Part B Highest point

How high does it go?

Essential Pre-Uni Physics B3.3

GCSE - Challenge (C3)
A Level - Challenge (C1)

Assume that any dropped or thrown object accelerates downwards at $9.8\,\mathrm{m\,s^{-2}}$. If a question says that an object is 'dropped' this means that its velocity is zero at the beginning of the motion.

Please give your answers to 2 significant figures. If asked for a velocity or displacement, your answer MUST contain a direction in order to be marked as correct. Take the positive direction to be upwards.

Part A Dropped weight

How much time does a dropped weight take to fall $120\,\mathrm{m}$ down a cliff?

Part B Thrown weight

How much time would the weight take to fall $120\,\mathrm{m}$ down the cliff if it was thrown downwards at $2.5\,\mathrm{m\,s^{-1}}$?

Essential Pre-Uni Physics B3.5

GCSE - Practice (P3)
A Level - Practice (P1)

Assume that any dropped or thrown object accelerates downwards at $9.8\,\mathrm{m\,s^{-2}}$. If a question says that an object is 'dropped' this means that its velocity is zero at the beginning of the motion.

Please give your answers to 2 significant figures. If asked for a velocity or displacement, your answer MUST contain a direction in order to be marked as correct. Take the positive direction to be upwards.

An aeroplane cannot take off until it is travelling at $80\,\mathrm{m\,s^{-1}}$. If its acceleration is $2.5\,\mathrm{m\,s^{-2}}$, how much distance does it travel while accelerating from rest to its take-off-speed?