

Physics Sub Plans Week, High School

Week-long sub plans: five days of print and go work for grades 9 to 12, planned Monday to Friday.

PREVIEW

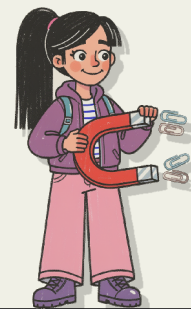
What is included

- Sub binder: notes, the filled-in week plan, a blank schedule, class list, Monday opener (11 pages)
- Physics sets for five days (15 pages)
- Calm puzzles and reset sheets (10 pages)
- Physics team tasks (9 pages)
- Physics games (10 pages)
- Answer keys (6 pages)

How it works

1. Open the week plan. Every set already has its day and page number.
2. Each day: one physics set per period (a lesson with worked examples, practice and a challenge), a calm puzzle, a team task and an optional game for the last 15 minutes.
3. Every set stands alone: swap sets between days, or use one with another class when it fits.
4. No prep, no tech: print and go. The sub needs no physics knowledge. Every answer is in the key.
5. Print in color or ink-saver black and white, US Letter or A4.

What this preview shows: the week at a glance, the filled-in week plan, the note to the substitute, the Monday opener, and all of Day 1 (the physics set, the calm block, the team task and the game), one answer-key page and one ink-saver page. Every product page is watermarked. The full kit has 62 pages.



Every physics set of the week, with its page and what it reviews. The day's set runs in every period you teach; any set works on any day.

MONDAY (DAY 1)

Opener	Meet Your Sub Fifteen minutes at the top of every period on Monday: the sub sheet, three questions, the class agreement and the voice levels.	p. 10 · 15 min
Physics set 1	Kinematics and Motion Graphs Reviews: distance and displacement, speed, velocity and acceleration, the kinematic equations, free fall, reading position time and velocity time graphs.	p. 13 · 50 min
Calm puzzle	Word Search and Reset Sheet A quiet subject word search and a two-minute reset sheet for a loud day, a long wait or anyone who finishes early.	p. 16 · 20 min
Team task	The Speed Lineup Groups of four rank twelve movers from a snail to the speed of sound by gut, then by converting each to meters per second, and score the gap.	p. 18 · 40 min
Game (optional)	Whiteboard Quiz Game Optional fun to end the class.	p. 19 · 15 min

TUESDAY (DAY 2)

Physics set 2	Newton's Laws and Forces Reviews: Newton's three laws, net force, $F = ma$, weight with $g = 9.8 \text{ N/kg}$, sliding friction, reading free-body diagrams.	p. 21 · 50 min
Calm puzzle	Sudoku and Grounding Sheet A hard sudoku with exactly one answer and a 5-4-3-2-1 grounding sheet for anyone who needs to come back into the room.	p. 24 · 20 min
Team task	The Cabin Power Plan Groups of four work out current and energy for nine appliances and build the comfiest plan a solar battery and a 20 A breaker allow.	p. 26 · 40 min
Game (optional)	Paper Password Optional fun to end the class.	p. 28 · 15 min

WEDNESDAY (DAY 3)

Physics set 3	Momentum and Collisions Reviews: momentum $p = mv$, impulse and change in momentum, conservation of momentum in collisions and push-offs, elastic and inelastic collisions.	p. 30 · 50 min
Calm puzzle	Secret Codes and Control Sheet Two coded sayings to crack in silence and a sheet that sorts what you can and cannot control this week.	p. 33 · 20 min
Team task	The Paper Bridge Groups of four fold a bridge from one or two sheets of paper that spans the gap between two books, then load it with pencils and explain why it holds.	p. 35 · 40 min
Game (optional)	Class Feud Optional fun to end the class.	p. 37 · 15 min

THURSDAY (DAY 4)

Physics set 4	Energy, Work and Power Reviews: work, kinetic and gravitational potential energy, conservation of energy on a roller coaster, power and efficiency.	p. 39 · 50 min
Calm puzzle	Maze and Brain Dump A long maze with exactly one true path and a brain dump sheet that turns a crowded head into one next step.	p. 42 · 20 min
Team task	The Skid Mark Inquiry Four members of a traffic review, each holding facts nobody else has, work out a skidding car's speed from its marks and test a witness's story.	p. 44 · 40 min
Game (optional)	Classroom Millionaire Optional fun to end the class.	p. 46 · 15 min

FRIDAY (DAY 5)

Physics set 5	Waves and Circuits Reviews: parts of a wave, wave speed $v = f$ times wavelength, sound and light basics, Ohm's law, series and parallel circuits, electrical power.	p. 48 · 50 min
Calm puzzle	Word Ladders and Three Good Things Four five-letter word ladders, three scrambled words and a three good things sheet to close out the week.	p. 51 · 20 min
Team task	The Solar Roof Debate Groups of four sort an evidence bank by side and by energy, power or force, then debate a solar roof for the school two against two.	p. 53 · 40 min
Game (optional)	Mystery Box Optional fun to end the class.	p. 55 · 15 min

How the sets work

- One set per day covers every period you teach: Monday's set runs in every Monday class.
- Every set stands alone. Swap sets between days, or use one with another class when it fits.
- Each set opens with a line that says what it reviews, so you can match it to what your class covered.
- The calm puzzle fits any gap, the team task fills a block period, and the game is optional fun for the last 15 minutes.
- No prep, no tech. Every answer is in the keys at the back, so the sub needs no physics knowledge.



This Week's Plan

You teach one subject to several classes, so every period you teach runs this same plan, first period to last: Monday's column in every Monday period, Tuesday's in every Tuesday period. Planning, lunch and duty periods: nothing to do. List your periods and classes on the blank schedule on the next page. This order is a sample: every set stands alone, so swap any set into any slot or any day.

WHEN	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
First 15 minutes: attendance, voice level, then	Meet Your Sub p. 10 · 15 min	Go over yesterday's answers Read them out from the key at the back; students mark their own (10 min)	Go over yesterday's answers Read them out from the key at the back; students mark their own (10 min)	Go over yesterday's answers Read them out from the key at the back; students mark their own (10 min)	Go over yesterday's answers Read them out from the key at the back; students mark their own (10 min)
Rest of the period: the day's set (one copy per student)	Physics 1 Kinematics and Motion Graphs p. 13 · 50 min	Physics 2 Newton's Laws and Forces p. 21 · 50 min	Physics 3 Momentum and Collisions p. 30 · 50 min	Physics 4 Energy, Work and Power p. 39 · 50 min	Physics 5 Waves and Circuits p. 48 · 50 min
If a class finishes early or gets loud	Word Search and Reset Sheet p. 16 · 20 min	Sudoku and Grounding Sheet p. 24 · 20 min	Secret Codes and Control Sheet p. 33 · 20 min	Maze and Brain Dump p. 42 · 20 min	Word Ladders and Three Good Things p. 51 · 20 min
Block period (90 minutes) only	The Speed Lineup p. 18 · 40 min	The Cabin Power Plan p. 26 · 40 min	The Paper Bridge p. 35 · 40 min	The Skid Mark Inquiry p. 44 · 40 min	The Solar Roof Debate p. 53 · 40 min
Last 15 minutes (optional): a fun way to end the class, or for extra time	Whiteboard Quiz Game p. 19 · 15 min	Paper Password p. 28 · 15 min	Class Feud p. 37 · 15 min	Classroom Millionaire p. 46 · 15 min	Mystery Box p. 55 · 15 min

How this week works

- You are covering a teacher who teaches one subject to several classes. Each class comes to this room once a day, for one period.
- So every class gets the same set on the same day: Monday's set in every Monday period, Tuesday's set in every Tuesday period.
- One set per day covers all your classes. Copy that day's set once per student in the morning. Planning, lunch and duty periods: nothing to run.
- Each set fills one period (45 to 55 minutes); the challenge at the end stretches it to a 90-minute block.

How to use this plan

- Page numbers point to the first page of each set. Copy one per student.
- The calm block is always allowed: a period that runs short, a loud class, or anyone who finishes early.
- The game is optional: a fun way to end the class, or something for extra time.



Note to the Substitute

Grades 9 to 12 · five days · every set runs from the printout alone

Thank you for covering my classes this week

Everything you need is in this binder. The front pages (important information, weekly schedule, class list) are filled in for this week. After them come the work sets, one per day: **Physics 1** is Monday's set, **Physics 2** is Tuesday's, and so on to **Physics 5** on Friday. Run the day's set in every period you teach that day. Each set is one period (45 to 55 minutes), stands alone, and has its own answer key at the back of the binder, so you never have to make anything up or know the subject. The first page of every set tells you what to say. Every set ends with a challenge, so it stretches to a 90-minute block when you need it.

After the subject sets come the shared blocks, one of each per day. The **calm block** is always allowed: for a period that runs short, a loud class, or anyone who finishes early. The **team task** fills a period on its own. The **game** is optional: a fun way to end the class, or something for extra time. Fifteen minutes, from the script.

Each day has

- One Physics set (one period, with a challenge to stretch it)
- A calm and quiet block: a puzzle page and a reset sheet
- A team task for groups of four
- A paper game from the script

If the class is loud

- Set a voice level with a number, 0 to 3, and use it all week (the Day 1 opener explains it).
- Switch to the calm block. Nobody needs to move.
- Every set has a challenge at the end, so fast finishers always have something.
- If a set is not working, stop it and use the calm block or the team task. Every set starts cold.

At the end of each day

Please fill in that day's line on the "How it went" page. It takes two minutes and I read every word.

Did this kit work well for your class? A quick review helps other teachers find it and earns you TpT credits. Thank you!



Meet Your Sub

Day 1 opener, 15 minutes at the start of every period on Monday, before the set. Nothing to prepare.

Opener

Sub script (the same five minutes in every class)

1. **Before first period, fill in the introduction sheet** on the next page, once, for the whole day. Keep it short and honest. A high school class reads a sub in about ten seconds, so give them something real to read.
2. **Introduce yourself from the sheet** in two minutes. Then hold up the Ask the Sub list and take three questions from raised hands. Three, not ten. Say when you are done taking questions.
3. **Read the class agreement out loud** and ask this period to add one line of their own. Write that line on the board for the period. The line they wrote is the one they keep.
4. **Set the voice level with a number** from 0 to 3, using the box at the bottom of the sheet. Say which level today's set needs, and use the same numbers in every class all week.
5. **Start the set** with one sentence: this is today's work, it has a challenge at the end, and the calm block is always allowed when you are finished.

If the room is loud

- Skip the questions. Keep the agreement and the voice level, and say the number out loud.
- Start the set sooner. Work on the desk beats a speech about behavior every time.
- Name the level again after four minutes. A number is easier to follow than a lecture.

If a period runs ten minutes short

- Run Common Ground in groups of four. Six minutes of work, four minutes of reading out.
- Or hand out the reset sheet from the calm block and let the room go quiet early.
- Or have each student write one question they would ask the teacher when they get back.

Monday checklist (before first period)

- ☐ Read the Important Information page: office extension, exits, the nurse, the teacher next door.
- ☐ Check the class list for allergies, medical needs, early releases and students who carry a pass.
- ☐ Find today's set on the weekly schedule and count copies for every period, plus five spares.
- ☐ Fill in the About Your Sub sheet once and post it where the back row can read it.
- ☐ Write the voice levels 0 to 3 on the board and leave them there all week.
- ☐ Keep the answer keys inside the binder, not face up on the desk.



Physics Set 1: Kinematics and Motion Graphs

Physics • Day 1

Read the four worked examples and the Remember box, then do the quick check. Use $g = 9.8 \text{ m/s}^2$. A calculator is fine if your school allows one; every number also works by hand.

This set reviews: distance and displacement, speed, velocity and acceleration, the kinematic equations, free fall, reading position time and velocity time graphs

1 Distance or displacement?

A runner goes 60 m east, then turns and goes 25 m west. Distance counts every meter traveled: $60 + 25$. Displacement is the change in position, with a direction: 60 east minus 25 west.

distance 85 m; displacement 35 m east

2 Acceleration

A car speeds up from 4 m/s to 22 m/s in 6 s. Acceleration is the change in velocity divided by the time: $(22 - 4) \div 6$.

$a = 3 \text{ m/s}^2$

3 Distance while speeding up

A cart starts from rest ($v_0 = 0$) and accelerates at 2.5 m/s^2 for 8 s. Use $\Delta x = v_0 t + \frac{1}{2} a t^2 = 0 + \frac{1}{2} \times 2.5 \times 8^2$.

$\Delta x = 80 \text{ m}$

4 No time given

A car moving at 20 m/s brakes at -5 m/s^2 until it stops ($v = 0$). Use $v^2 = v_0^2 + 2a\Delta x$: $0 = 20^2 + 2(-5)\Delta x$, so $\Delta x = 400 \div 10$.

$\Delta x = 40 \text{ m}$

Remember

- Distance** is the total length of the path (never negative). **Displacement** is the straight-line change in position from start to finish, and it has a direction.
- Speed** = distance $\div$ time. **Velocity** = displacement $\div$ time, with a direction. Pick one direction (east, right or up) as positive; the opposite direction is negative.
- Acceleration** = change in velocity $\div$ time, in m/s^2 . A negative acceleration on something moving in the positive direction means it is slowing down.
- Constant acceleration:** $v = v_0 + at$ | $\Delta x = v_0 t + \frac{1}{2} a t^2$ | $v^2 = v_0^2 + 2a\Delta x$ | $\Delta x = \frac{1}{2}(v_0 + v)t$. List what you know and what you want, then choose the equation that leaves out the one quantity you do not have.
- Free fall:** ignoring air, everything near Earth's surface accelerates downward at $g = 9.8 \text{ m/s}^2$. "Dropped" means $v_0 = 0$. A ball thrown up has $v = 0$ at the very top.

Quick check

1. Theo walks 40 m north, then 40 m south. Give his distance and his displacement.

2. A bus travels 150 m in 30 s. Find its average speed.

3. A scooter speeds up from 6 m/s to 18 m/s in 4 s. Find its acceleration.

4. A stone is dropped from rest. How fast is it falling after 3 s?



Physics Set 1: Practice

Sixteen problems in four blocks. Write the equation you use, then the answer with its unit on the line.

Physics • Day 1

A. Distance and displacement

1. A dog runs 30 m east, then 12 m west. Distance? Displacement?

2. Luis swims four lengths of a 25 m pool and ends where he started. Distance? Displacement?

3. Priya walks 300 m east, then 400 m north. Distance? Size of her displacement?

4. An elevator rises 18 m, then goes down 30 m. Distance? Displacement?

B. Speed, velocity, acceleration

1. A train covers 540 m in 45 s. Find its average speed.

2. A skateboarder speeds up from 2 m/s to 8 m/s in 3 s. Find the acceleration.

3. A bus slows from 15 m/s to 3 m/s in 4 s. Find the acceleration.

4. Nadia runs once around a 400 m track in 80 s. Find her average speed and her average velocity.

C. Constant acceleration

1. A car starts from rest and accelerates at 4 m/s^2 for 5 s. Find its final velocity.

2. A cart starts from rest and accelerates at 3 m/s^2 for 6 s. How far does it travel?

3. A bike moving at 6 m/s accelerates at 1.5 m/s^2 for 4 s. Find its final velocity.

4. A plane starts from rest and reaches 60 m/s at the end of a 900 m runway. Find its acceleration.

D. Free fall ($g = 9.8 \text{ m/s}^2$)

1. A stone is dropped from rest. Find its speed after 2 s.

2. A stone is dropped from rest. How far does it fall in 3 s?

3. A ball is thrown straight up at 19.6 m/s. How long does it take to reach the top?

4. A ball is dropped from rest and hits the ground at 14.7 m/s. How long did it fall?

Give a direction with every displacement and velocity (east, west, up, down, or a sign). Units: meters (m), seconds (s), meters per second (m/s), meters per second squared (m/s^2).

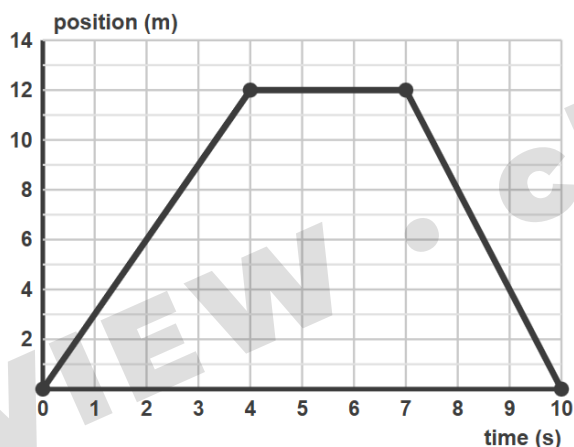


Physics Set 1: Read the Motion Graphs

Read each value straight off the grid. On a position-time graph the slope is the velocity; on a velocity-time graph the slope is the acceleration and the area is the displacement.

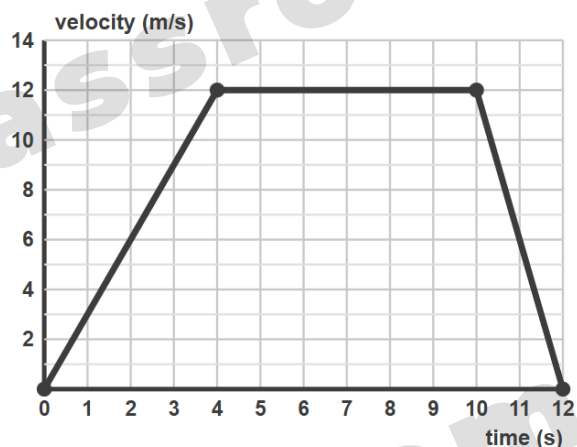
Physics • Day 1

Maya's walk: position-time



- 1 Find Maya's velocity from $t = 0$ to $t = 4$ s.
.....
- 2 What is she doing from $t = 4$ s to $t = 7$ s? How can you tell?
.....
- 3 Find her velocity from $t = 7$ s to $t = 10$ s. What does the sign tell you?
.....
- 4 Find her total distance and her displacement for the 10 s.
.....

A car: velocity-time



- 5 Find the car's acceleration from $t = 0$ to $t = 4$ s.
.....
- 6 Find its acceleration from $t = 10$ s to $t = 12$ s.
.....
- 7 The area under a velocity-time graph is the displacement. How far does the car go in the first 4 s?
.....
- 8 How far does the car travel in the whole 12 s?
.....

Challenge

- 1 A driver moving at 25 m/s sees a hazard. During her 0.8 s reaction time the car keeps going at 25 m/s; then it brakes at -5 m/s^2 until it stops. Find the reaction distance, the braking distance and the total stopping distance.
.....
- 2 A ball is thrown straight up at 29.4 m/s. Find the time to reach the top, the maximum height, and the total time in the air.
.....
- 3 Amara starts 20 m ahead of Theo and runs at 5 m/s. Theo starts at the same moment and runs the same way at 7 m/s. When does he catch her, and how far has he run?
.....



Calm Block, Day 1: Word Search

Calm • Day 1

Find all 12 physics words. Any direction, including backward and diagonal. Pencils only, voices at 0.

Y	I	M	P	U	L	S	E	G	A	D	R	O	L
Y	S	E	V	C	X	X	H	S	C	L	X	T	A
B	M	F	U	I	Y	T	I	C	O	L	E	V	D
O	M	H	S	T	Z	I	M	L	P	I	J	Q	E
W	Y	Q	D	E	W	U	L	J	W	U	O	J	Q
E	N	M	J	N	A	C	I	I	O	J	U	W	Q
M	M	V	D	I	T	R	N	A	I	Z	L	Z	F
C	U	U	U	K	T	I	V	N	W	L	E	R	Y
B	T	Y	F	U	F	C	E	E	H	K	I	W	N
C	N	U	I	H	K	R	M	L	C	C	H	Q	E
U	E	E	G	A	T	L	O	V	T	T	W	M	W
J	M	O	B	I	F	R	B	I	G	F	O	D	T
M	O	V	A	C	R	X	O	L	N	Y	R	R	O
D	M	I	A	Z	Y	N	Z	X	U	W	S	P	N

VELOCITY

MOMENTUM

FRICTION

INERTIA

KINETIC

VOLTAGE

CIRCUIT

IMPULSE

NEWTON

VECTOR

JOULE

WATT

Faster than reading every square

- Hunt the rare letters first. Only one word in the list has a J in it, so every J in the grid is worth a second look.
- Scan one row at a time for a word's first two letters, then check all eight directions from that square.
- Cross a word off the list the second you circle it, or you will search for it twice.



Calm Block, Day 1: Reset Sheet

For one person, at your own pace. Nobody collects this and nobody reads it but you.

Calm • Day 1

Two minutes, then back to it

This is not a mood test and it is not therapy. It is a short routine for the moments when your head is somewhere else and the work in front of you is going nowhere: slow the breath, put a name on the feeling, pick the next five minutes. Work down the page and stop at the bottom.

Step 1: make the breath out longer

Breathe in through your nose while you count to four, then out through your mouth while you count to six. The long breath out is the part that slows your heart rate down. Six rounds, then stop.

Check a box for each round so you are not counting in your head.

□ □ □ □ □ □

Step 2: name it

A feeling you can name gets smaller. Tired, annoyed, behind, worried, bored, flat, wired. One word is enough, and it does not have to be the right word.

Write yours on the first line below.

Name it in one word, then write the sentence your head keeps repeating

.....

.....

What is actually true right now, in this room, that I could check in ten seconds

.....

.....

The next five minutes: what I will do the moment I put this sheet down

.....

.....

What usually helps me

- ☐ Water and a real breath of air
- ☐ Writing the thing down instead of holding it
- ☐ Two minutes of a puzzle or a doodle
- ☐ Starting the smallest piece of the work
- ☐ Standing up and stretching my shoulders
- ☐ Putting my phone face down in my bag
- ☐ Asking one person one question
- ☐ Deciding to deal with it after school

My own line

Something that works for you that is not on that list.

.....

.....

Right now I feel (circle one)

1 2 3 4 5 6 7 8 9 10

1 = settled, 10 = about to boil over. Check the same number again in ten minutes. Down by one is the whole point.



Team Task, Day 1: The Speed Lineup

Groups of four. Voice level 2. Calculators only if your school allows them. One sheet per group, one person writes, and no group rank goes down until all four agree.

Team • Day 1

The challenge

Twelve things are moving, and every speed is hidden in a different unit: kilometers per hour, minutes, centimeters, an echo, a fall. **Your job:** rank them from **1 (fastest)** to **12 (slowest)**.

Step 1: alone, in three minutes, fill in "My rank" by instinct. **Step 2:** split the movers, three each, change every one into meters per second, check each other's work, and agree on the group rank, using each rank once. The sub then reads out the true order: **speed in meters per second, fastest first.**

Mover	My rank	Group rank	Speed (m/s)	True rank	Difference
A A stone dropped from a bridge, 2 s after it is let go					
B A student who walks 1.35 km to school in 15 minutes					
C A passenger jet cruising at 900 km/h					
D A garden snail that crawls 90 cm in 10 minutes					
E A cheetah that covers 140 m in 5 s					
F A fastball that crosses 18 m to home plate in 0.45 s					
G A car driving at 72 km/h					
H A cyclist who rides 9 km in 30 minutes					
I A shout's echo off a cliff 686 m away, back in 4 s					
J An elevator that rises 72 m in 12 s					
K A car 8 s after pulling away from rest at 3 m/s^2					
L A sprinter who runs 100 m in 10 s					
Total difference (lower is better)					

Conversions and scoring

- km/h to m/s:** divide by 3.6. **km to m:** times 1,000. **cm to m:** divide by 100. **Minutes to s:** times 60.
- From rest:** $v = at$. **Falling:** $v = gt$, $g = 9.8 \text{ m/s}^2$. **An echo** goes there and back.

Difference = group rank minus true rank, sign dropped, added over the twelve rows. Score "My rank" the same way.

0 to 6: excellent: your group converts like a physics lab; **7 to 14:** good; **15 to 24:** fair; **25 or more:** redo the conversions together.

Cut versus physics

Which mover fooled your instinct the most, and which unit hid its real speed?

.....

Challenge: movers L and D race 100 m. How long does each one take? Give the snail's time in hours.

.....

.....



Game, Day 1: Whiteboard Quiz Game

Sub script and questions. 15 minutes at the end of the period, or for extra time. Optional.

Game • Day 1

Set up (2 minutes)

1. Draw a 5 by 5 grid on the board, or tape up the board sheet. Write the five category names across the top and the values 100 to 500 down each column.
2. Teams of four to six. Team 1 picks a category and a value.
3. Read the question. The team gets 15 seconds and one answer. Right: they take the points and pick again.
Wrong: the next team may steal, then play moves on.
4. Cross the square off. Highest total when time is up wins.

Read this out

"One voice per team: pick a captain who says the final answer. Shouted answers do not count and the square is dead. Team 1, choose a category and a value."

Keep the running score in a corner of the board. If a team argues a call, the script wins and the game moves on. The bold answer is the one to accept, but take a clear equivalent too (20 newtons for 20 N, amps for amperes).

Motion

100 What is speed in a given direction called?

Velocity

200 What is the rate of change of velocity called?

Acceleration

300 What is the SI unit of acceleration?

Meters per second squared

400 A car covers 300 m in 20 s. What is its average speed?

15 m/s

500 A dropped stone falls for 2 s with $g = 9.8 \text{ m/s}^2$. How fast is it going?

19.6 m/s

Waves

100 What is the highest point of a transverse wave called?

A crest

200 What unit is used to measure frequency?

The hertz

300 Is sound in air a transverse or a longitudinal wave?

Longitudinal

400 Which travels faster through air, light or sound?

Light

500 A wave has a frequency of 10 Hz and a wavelength of 2 m. What is its speed?

20 m/s

Forces

100 Which force pulls objects toward the center of Earth?

Gravity

200 What force opposes two surfaces sliding past each other?

Friction

300 Which of Newton's laws is called the law of inertia?

The first law

400 What net force gives a 5 kg cart an acceleration of 4 m/s^2 ?

20 N

500 What is the weight of a 10 kg mass, with $g = 9.8 \text{ N/kg}$?

98 N

Electricity

100 What is the flow of electric charge called?

Current

200 What unit is used to measure resistance?

The ohm

300 Which law says voltage equals current times resistance?

Ohm's law

400 What is the total resistance of 4 ohms and 6 ohms in series?

10 ohms

500 A 12 V battery is connected to a 3 ohm resistor. How many amps flow?

4 amps

Energy

100 What is the energy of motion called?

Kinetic energy

200 What is the SI unit of work and energy?

The joule

300 What is the rate of doing work called?

Power

400 How much work is done pushing a box 4 m with a 50 N force?

200 J

500 What is the kinetic energy of a 2 kg ball moving at 3 m/s?

9 J

Final Wager: Momentum

Play this when the board is clear, or when two minutes are left. Announce the category, then every team writes a secret wager of up to the points it already has. Read the question. Teams get 60 seconds of silent writing, then hold their answers up together.

A 2 kg cart moving at 3 m/s hits a 1 kg cart at rest, and they stick together. How fast do they move?

2 m/s

Right: add the wager. Wrong: subtract it. That is the final score.



Game, Day 1: The Board

Tape this to the whiteboard or copy it. Cross squares off as they are played.

Game • Day 1

MOTION	FORCES	ENERGY	WAVES	ELECTRICITY
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

Scores

Team 1

.....

.....

.....

Team 2

.....

.....

.....

Team 3

.....

.....

.....

Team 4

.....

.....

.....

Team 5

.....

.....

.....

Team 6

.....

.....

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Final Wager: Momentum

Write your wager before you hear the question. A team may bet any amount up to the points it already has. Right answer: add the wager. Wrong answer: subtract it.

Team 1

WAGER

ANSWER

Team 2

WAGER

ANSWER

Team 3

WAGER

ANSWER

Team 4

WAGER

ANSWER

Team 5

WAGER

ANSWER

Team 6

WAGER

ANSWER



Answer Keys (1 of 6)

Teacher copy. Keep these pages out of the student sets.

Physics Set 1: Kinematics and Motion Graphs

Quick check: 1. 80 m; 0 m; 2. 5 m/s; 3. 3 m/s²; 4. 29.4 m/s

Distance and displacement: 1. 42 m; 18 m east; 2. 100 m; 0 m; 3. 700 m; 500 m (a right triangle: 300, 400, 500); 4. 48 m; 12 m down

Constant acceleration: 1. 20 m/s; 2. 54 m; 3. 12 m/s; 4. 2 m/s²

Graphs: 1. 3 m/s (12 m in 4 s); 2. standing still: the line is flat, so her velocity is 0; 3. -4 m/s: negative, so she is walking back toward the door; 4. 24 m; 0 m (she ends at the door); 5. 3 m/s²; 6. -6 m/s² (braking); 7. 24 m (a triangle: $\frac{1}{2} \times 4 \times 12$); 8. 108 m ($24 + 72 + 12$)

Challenge: 1. $20 \text{ m} + 62.5 \text{ m} = 82.5 \text{ m}$; 2. 3 s; 44.1 m (average velocity 14.7 m/s for 3 s); 6 s; 3. after 10 s; 70 m

Accept answers with the right size and a clear direction, in words or with a sign.

Speed, velocity, acceleration: 1. 12 m/s; 2. 2 m/s²; 3. -3 m/s² (slowing down); 4. 5 m/s; 0 m/s (she ends where she started)

Free fall: 1. 19.6 m/s; 2. 44.1 m; 3. 2 s (it slows by 9.8 m/s every second); 4. 1.5 s

Calm block, Day 1: word search solution (physics words)



All 12 words are marked. Words run in all eight directions, so a student who only searched across and down will be missing several.

Reset sheet: private, answers vary, nothing to grade. If a student hands it in anyway, thank them and leave it for the teacher.

Physics Set 2: Newton's Laws and Forces

Which law: 1. 1; 2. 3; 3. 2; 4. 1; 5. 3; 6. 2. (1 = first law (inertia), 2 = second law ($F = ma$), 3 = third law (action and reaction).)

Free-body diagrams: A. net force 12 N right, $a = 3 \text{ m/s}^2$ right; B. net force 0, $a = 0$: balanced, so it stays at rest (or moves at a constant velocity); C. net force 15 N up, $a = 3 \text{ m/s}^2$ up; D. net force 10 N left, $a = 5 \text{ m/s}^2$ left. A, C and D are unbalanced; B is balanced.

Use $F = ma$: 1. 3,000 N; 2. 200 m/s²; 3. 90 kg; 4. 240 N

Weight and mass: 1. 686 N; 2. 30 kg; 3. 112 N; 4. 70 kg: mass does not change, only weight does

Friction and forces at work: 1. 245 N; 98 N; 2. 40 N; 4 m/s²; 3. 45 N; the first law: constant velocity means the net force is 0 (also accept the second law with $a = 0$); 4. 19.6 N ($0.25 \times 78.4 \text{ N}$); 5. 2,400 N forward; 2 m/s²; 6. 2 m/s²; 8 m/s

Challenge: 1. 196 N; 49 N; 60 N; 3 m/s²; 2. 708 N ($N - 588 = 60 \times 2$); 588 N; 3. the two forces act on different objects (one on the cart, one on the horse), so they cannot cancel; the cart speeds up whenever the 800 N pull on it is bigger than the friction on it. Accept any explanation of 3 that says the forces act on different objects.



Physics Set 1: Practice

Sixteen problems in four blocks. Write the equation you use, then the answer with its unit on the line.

Physics • Day 1

A. Distance and displacement

1. A dog runs 30 m east, then 12 m west. Distance? Displacement?

2. Luis swims four lengths of a 25 m pool and ends where he started. Distance? Displacement?

3. Priya walks 300 m east, then 400 m north. Distance? Size of her displacement?

4. An elevator rises 18 m, then goes down 30 m. Distance? Displacement?

B. Speed, velocity, acceleration

1. A train covers 540 m in 45 s. Find its average speed.

2. A skateboarder speeds up from 2 m/s to 8 m/s in 3 s. Find the acceleration.

3. A bus slows from 15 m/s to 3 m/s in 4 s. Find the acceleration.

4. Nadia runs once around a 400 m track in 80 s. Find her average speed and her average velocity.

C. Constant acceleration

1. A car starts from rest and accelerates at 4 m/s^2 for 5 s. Find its final velocity.

2. A cart starts from rest and accelerates at 3 m/s^2 for 6 s. How far does it travel?

3. A bike moving at 6 m/s accelerates at 1.5 m/s^2 for 4 s. Find its final velocity.

4. A plane starts from rest and reaches 60 m/s at the end of a 900 m runway. Find its acceleration.

D. Free fall ($g = 9.8 \text{ m/s}^2$)

1. A stone is dropped from rest. Find its speed after 2 s.

2. A stone is dropped from rest. How far does it fall in 3 s?

3. A ball is thrown straight up at 19.6 m/s. How long does it take to reach the top?

4. A ball is dropped from rest and hits the ground at 14.7 m/s. How long did it fall?

Give a direction with every displacement and velocity (east, west, up, down, or a sign). Units: meters (m), seconds (s), meters per second (m/s), meters per second squared (m/s^2).

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checked

Thank you! If this works for your class, a quick review helps other teachers find it, and earns you TpT credits.

