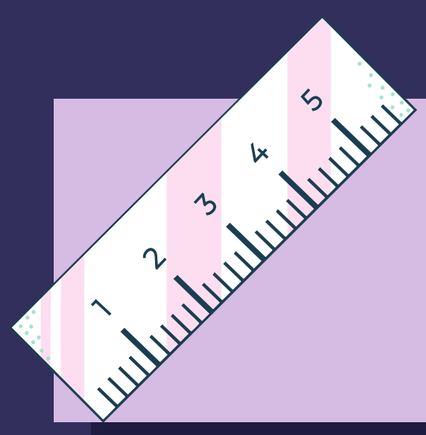
FORCE & MOTION WORKBOOK

11 Pages of Practice Problems

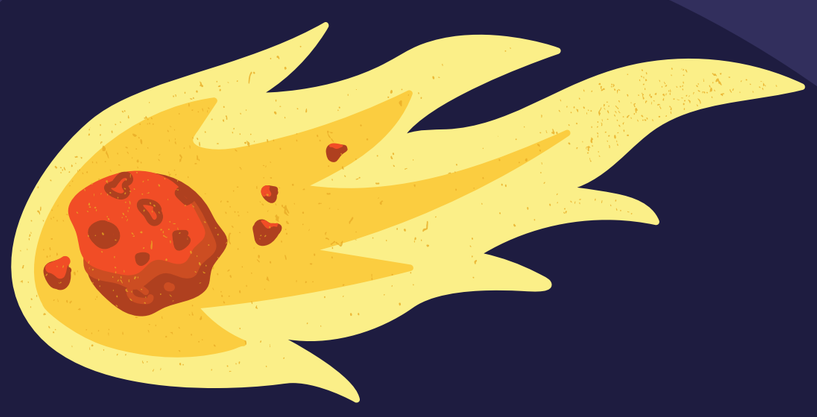


Unit Conversions

Speed & Velocity

Acceleration

Force



Grade 8-10

Course: _____ Name: _____

Force & Motion Workbook

Part A: Matching

Match the term on the left with the definition on the right. Write your answer in the left-hand column.

	1. Motion	A. The duration of an event
	2. Force	B. The rate at which an object speeds up
	3. Distance	C. The force that pulls objects towards the ground
	4. Speed	D. The rate at which an object slows down
	5. Time	E. The space between two points
	6. Velocity	F. A visual representation of an object's motion that can be used to determine its speed
	7. Acceleration	G. The action of an object changing position or location
	8. Deceleration	H. The force of two objects sliding against each other
	9. Constant speed	I. The rate at which an object moves in a particular direction
	10. Gravity	J. When an object maintains its speed without accelerating or decelerating
	11. Friction	K. A push or pull that starts, stops, or changes the motion of an object
	12. Distance-time graph	L. The distance an object travels in a certain amount of time

Part B. Unit Conversions

When dealing with motion, it is important to be able to work with the different units used to measure distance, time, and speed. In this section, you will practice converting between SI units. Make sure to ***show your work***.

1. Convert between meters and kilometers. 1 km = 1000 m

   a) 1500 m to km

   b) 13.6 km to m

   c) 0.635 km to m

   d) 990,455 m to km

   e) 34,809 m to km

   f) 1.546 km to m

2. Convert between hours, minutes, and seconds. 1 h = 60 min, 1 min = 60 s

   a) 2.17 h to min

   b) 906 s to h

   c) 48 min to s

d) 1896 s to h

e) 0.76 h to s

f) 3.98 h to s

3. Convert between km/h and m/s.

a) 60 km/h to m/s

b) 3.7 m/s to km/h

c) 233 km/h to m/s

d) 9.8 m/s to km/h

e) 0.46 m/s to km/h

f) 22.8 km/h to m/s

Part C: Calculating Distance, Time, and Speed

Use the formula for average speed to solve the following problems. Make sure to ***show your work*** and ***pay attention to the units***.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

1. I bee flies 14 km to reach its food source, which takes half an hour. How fast is the bee flying in km/h?

2. The Formula Rossa at Ferrari World in Abu Dhabi is the fastest roller coaster in the world, reaching up to 240 km/h. How long does it take to complete its 6133 m track?

3. The ferry route from Victoria to Tsawwassen is 45 km and takes 95 minutes. What is the average speed of the ferry in km/h?

4. I am driving from Vancouver to Kelowna, which is 390 km. If I want to get there in 4 hours, how fast do I need to drive?

5. My new Nerf gun can shoot a foam dart at a speed of 21 m/s. If my brother is standing 7.4 m away from me, how long will it take for the dart to hit him?

6. I have a 30 m long Slip ‘n’ Slide. If I slide down it at a speed of 6.4 m/s, how long will it take me to reach the end?

7. The albatross can fly 15,000 km over the ocean without ever touching land. If it is flying at a speed of 80 km/h, how long does it spend in the air?

8. It takes 2.7 s for a child to go down a 3.5-meter-long slide. What is the child’s average speed?

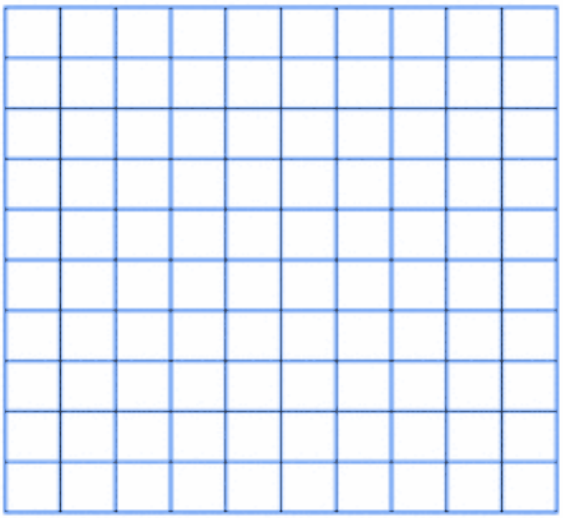
9. Bamboo can grow at a rate of 0.04 m per hour. How much will it grow in 24 hours?

10. A marine biologist wants to know how fast dolphins swim on average. Using a GPS tracking device, she measures the distance travelled by a dolphin every 5 seconds.

a) Plot the data from Table 1 in a distance-time graph. Remember to give your graph a title and to label the x-axis and the y-axis. Draw a line of best fit.

Table 1. Motion of a Dolphin

Time (s)	Distance (m)
0	0
5	33
10	64
15	100
20	131
25	162
30	198
35	229
40	265
45	300
50	333



b) Find the average speed of the dolphin in m/s by calculating the slope of the line.

c) What is the dolphin's speed in km/h?

Part D: Calculating Acceleration, Velocity, and Time

Use the acceleration formula to solve the problems below. Remember to show all your work.

$$a = \frac{v_f - v_i}{\Delta t}$$

1. A Formula One race car can go from 0 to 60 km/h in 1.6 s. What is its acceleration in m/s^2?

2. A marble is dropped off the roof of a building. Due to gravity, it accelerates at 9.8 m/s^2 and reaches a velocity of 48 m/s. How long does it take to hit the ground?

3. A bald eagle dives down from a tree branch to catch a fish. It accelerates at 22.4 m/s^2 and reaches the surface of the water in 7.3 s. What was its final velocity?

4. A car is driving at a constant speed. It then speeds up to 54 m/s at a rate of 4 m/s^2. If it takes the car 8 s to accelerate, what was its initial velocity?

5. Wile E. Coyote is chasing after the roadrunner. He launches himself on a rocket that travels at a velocity of 55 m/s. However, the roadrunner tied the rocket to a bungee cord, which causes the rocket to slow down and stop within 3.4 s. What is the rate of deceleration of the rocket?

6. A cyclist is travelling at a velocity of 12.5 m/s, when he slams on his brakes to avoid hitting a car. He slows down at a rate of 5.1 m/s^2 to a velocity of 1.3 m/s. How long does it take him to slow down?

7. The Flash can run 4075 km/h. It takes him 0.5 s to accelerate from walking at 6 km/h. What is his rate of acceleration in m/s^2?

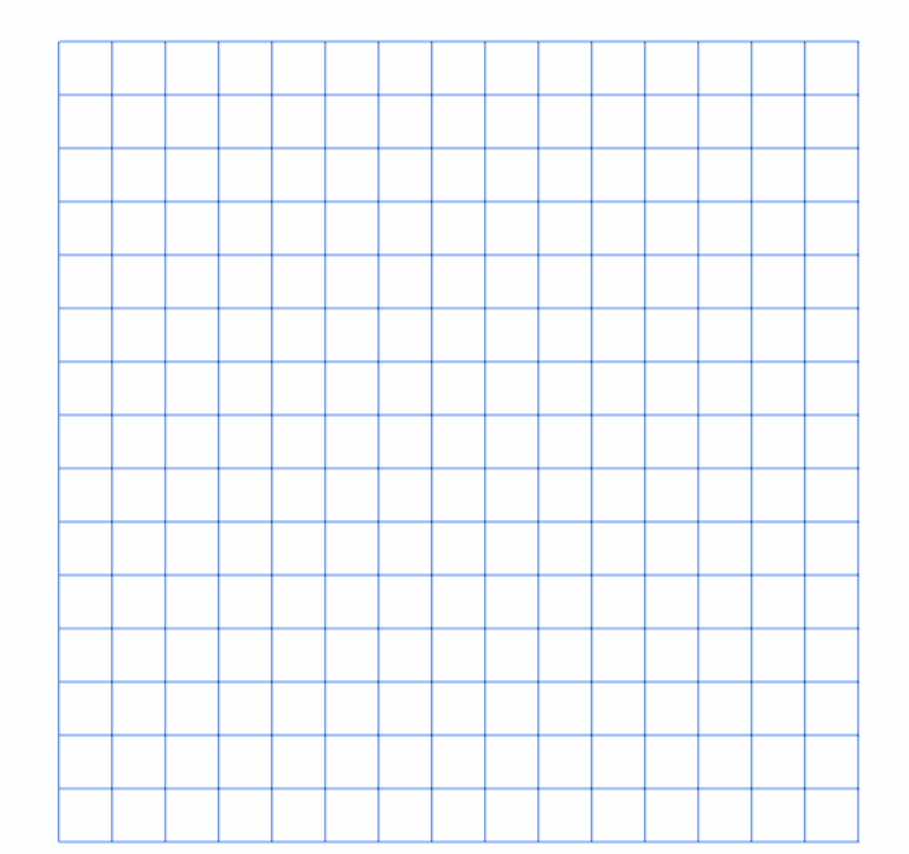
8. The acceleration due to gravity on the Moon is 1.6 m/s^2. If an astronaut jumps into a crater, how long would it take them to speed up from 0 m/s to 3 m/s?

9. Table 2 shows time and distance data for a downhill skier:

Table 2. Motion of a Skier

Time (s)	Distance (m)
0	0
1	2
2	4
3	8
4	16
5	32
6	64
7	128

a) Use the data from Table 2 to draw a distance-time graph. Remember to give your graph a title and label the axes.



b) Describe the line of the graph. How does it differ from the graph you drew in Part C question 11?

c) How fast is the skier going at 7 s? Give your answer in m/s and km/h.

d) Using the velocity at 7 s, calculate the skier's average rate of acceleration in m/s^2.

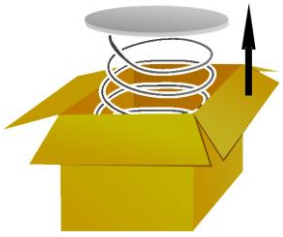
e) If they continue to accelerate at this rate, what will their velocity be at 10 s? Give your answer in m/s and km/h.

f) The world record skiing velocity is 255 km/h. What prevents them from going faster? (hint: what types of ***forces*** are affecting the skier?)

Part E: Force

For each of the images below, indicate which type of force is represented using the terms in the box.

Applied force	***Spring force***	***Drag force***	***Frictional force***
Normal force	***Magnetic force***	***Electric force***	***Gravitational force***

1. 	2. 
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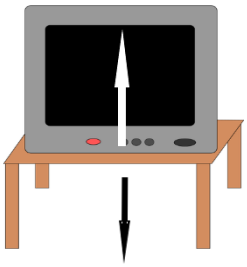
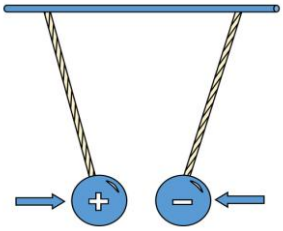
5. 	6. 
7. 	8. 

ANSWER KEY: Force and Motion Workbook

Part A: Matching

1. G
2. K
3. E
4. L
5. A
6. I
7. B
8. D
9. J
10. C
11. H
12. F

Part B: Unit Conversions

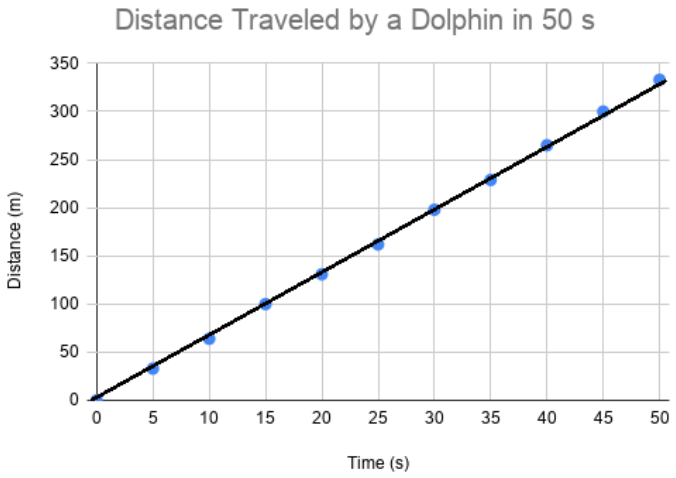
1. a) 1.5 km
b) 13, 300 m
c) 635 m
d) 990.455 km
e) 34.809 km
f) 1546 m

2. a) 130.2 min
b) 0.25 h
c) 2880 s
d) 0.53 h
e) 2736 s
f) 14,328 s

3. a) 16.67 m/s
b) 13.32 km/h
c) 64.72 m/s
d) 35.28 km/h
e) 1.66 km/h
f) 6.33 m/s

Part C: Calculating Distance, Time, and Speed

1. 28 km/h
2. 92 s
3. 28.4 km/h
4. 97.5 km/h
5. 0.35 s
6. 4.7 s
7. 187.5 h
8. 1.3 m/s
9. 0.96 m
10. a) see graph
b) 6.7 m/s (answers may vary slightly)
c) 24 km/h (answers may vary slightly)



ANSWER KEY: Force and Motion Workbook

Part D: Calculating Acceleration, Velocity, and Time

1. 37.5 m/s^2
2. 4.9 m/s
3. 163.5 m/s
4. 22 m/s
5. -16.2 m/s^2
6. 2.2 s
7. 2261 m/s^2
8. 1.9 s
9. a) see graph

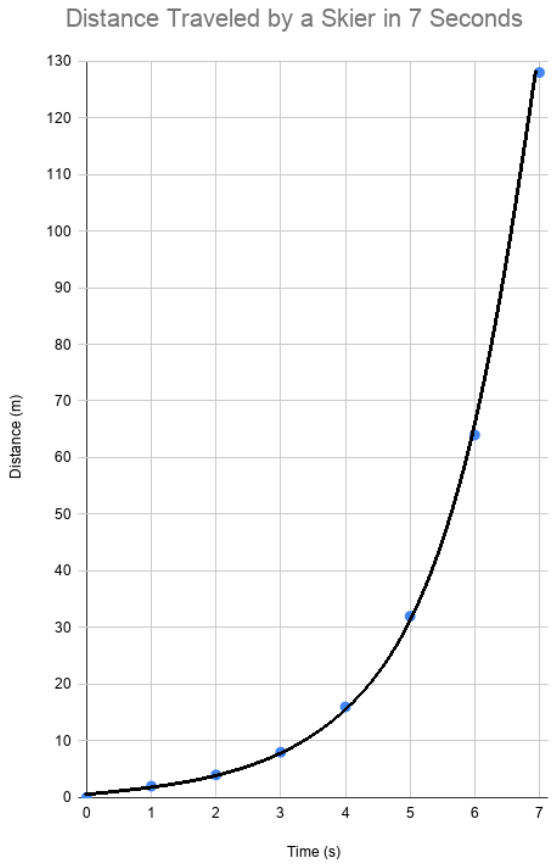
b) The line curves upwards and continuously gets steeper and steeper, whereas the line in the previous graph was straight.

c) 18.3 m/s; 65.8 km/h

d) 2.6 m/s^2

e) 26 m/s; 94 km/h

f) The velocity and acceleration of skiers is limited in the real world because of friction between the skis and the snow. The force of friction works in the opposite direction of the skier and slows them down.



Part E: Force

1. applied force
2. spring force
3. gravitational force
4. drag force
5. magnetic force
6. normal force
7. electrical force
8. frictional force