Fill in the table below

Was Stopped	**No Net Force =** Staying stopped **Net Force =** Gaining speed
Was Moving	**No Net Force =** constant speed **Net Force with motion =** Gaining Speed **Net Force against motion =** Losing Speed

Types of Motion:

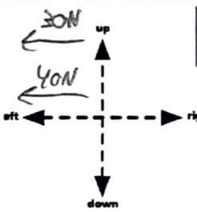
Staying Stopped

Constant Speed

Gaining Speed

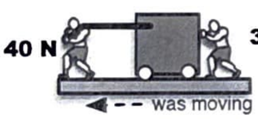
Losing Speed

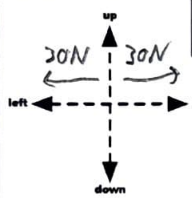
Fill in the Net Force, the direction of Net Force and what kind of motion the object is undergoing for the following scenarios.



Fnet	direction
70 N	←

- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.



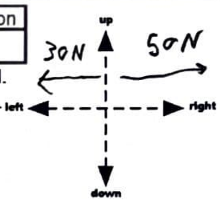


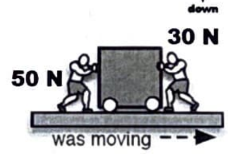
Fnet	direction
0	—

- [x] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [ ] losing speed.

Fnet	direction
20 N	→

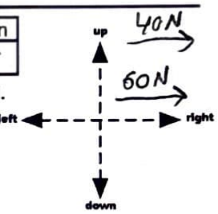
- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.

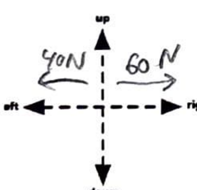




Fnet	direction
100 N	→

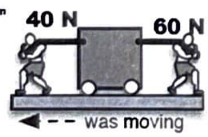
- [ ] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [x] losing speed.

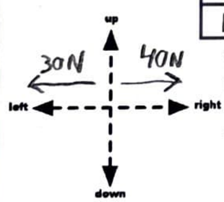




Fnet	direction
20 N	→

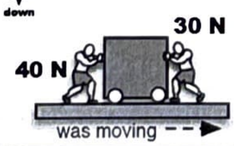
- [ ] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [x] losing speed.





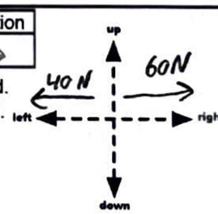
Fnet	direction
10N	→

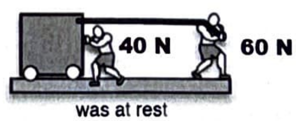
- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.



Fnet	direction
20N	→

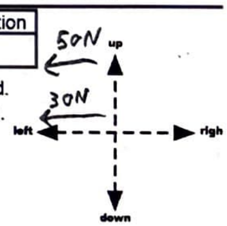
- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.

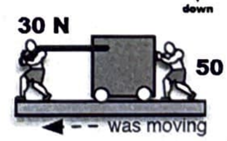


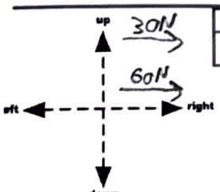


Fnet	direction
80N	←

- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.

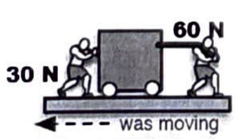


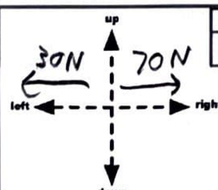




Fnet	direction
90N	→

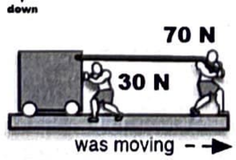
- [ ] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [x] losing speed.





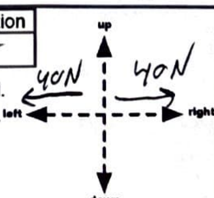
Fnet	direction
40N	→

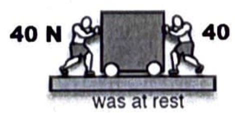
- [ ] staying stopped.
- [ ] constant speed.
- [x] gaining speed.
- [ ] losing speed.



Fnet	direction
0	—

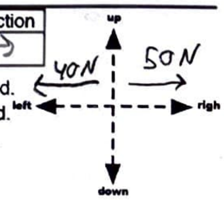
- [x] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [ ] losing speed.

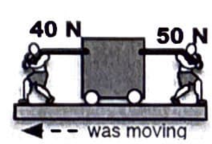




Fnet	direction
10N	→

- [ ] staying stopped.
- [ ] constant speed.
- [ ] gaining speed.
- [x] losing speed.





Match which description corresponds with each dot pattern.

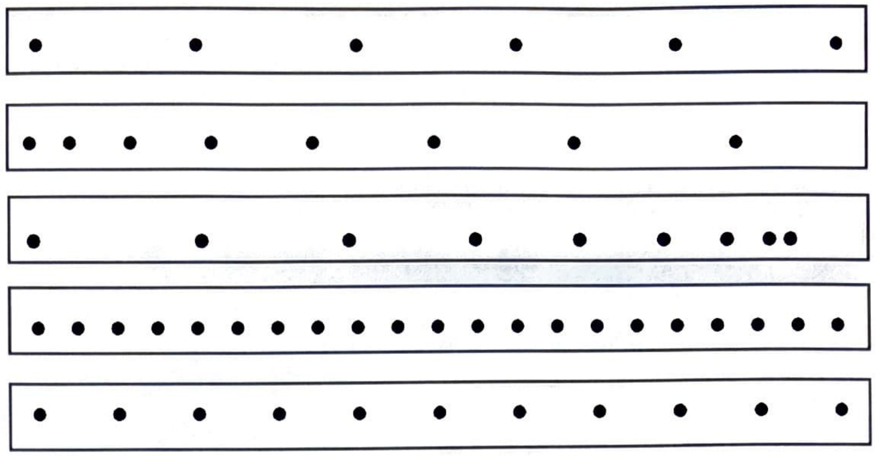
a.) A car traveling at 20 mph. d Start End

b.) A car traveling at 40 mph. c Start End

c.) A car speeding up. e Start End

d.) A car traveling at 80 mph. a Start End

e.) A car slowing to a stop. b Start End



- The force that keeps us on the surface of the Earth, keeps the Moon in orbit around the Earth and yields 10 Newton's of this force for every 1 kg of mass is called Gravity (weight)

- The force that arises because all solid objects are inherently springy due to the molecular bonds that hold them together is called Normal

- The force that arises because solid objects are rough, jaggedly and bumpy is called Friction

- The force that a rises due to solid objects interacting with fluids, like air and water and is essential to skydiving is Drag

- The force that arises when solid objects are stretched or compressed, commonly present in things like ropes, strings, and rubber bands is called Tension

<u>Word Bank:</u>

Gravity (weight) Friction

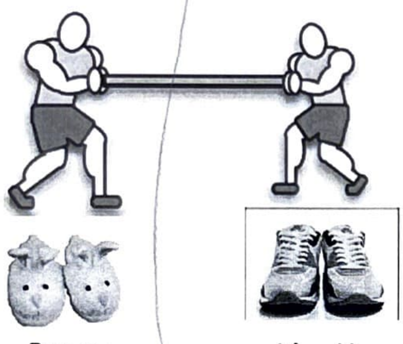
Normal Tension Drag

Force of Friction	= Cof x	Force that pushes the surfaces together

Calculate the friction for each person and circle who would win the tug of war.

Andre the Giant
Weight = 1600 N

Achilles
Weight = 1200 N



Bunny Slippers
CoF = 0.2

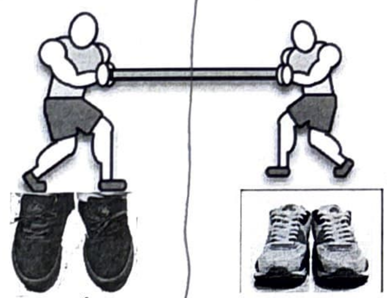
Air Max
CoF = 0.5

(1600N)(0.2) = 320N

(1200N)(0.5) = 600 N

Brian Shaw
Weight = 2000 N

Eddie Hall
Weight = 1800 N



Emerica Reynolds
CoF = 0.6

Air Max
CoF = 0.7

(2000N)(0.6) = 1200 N

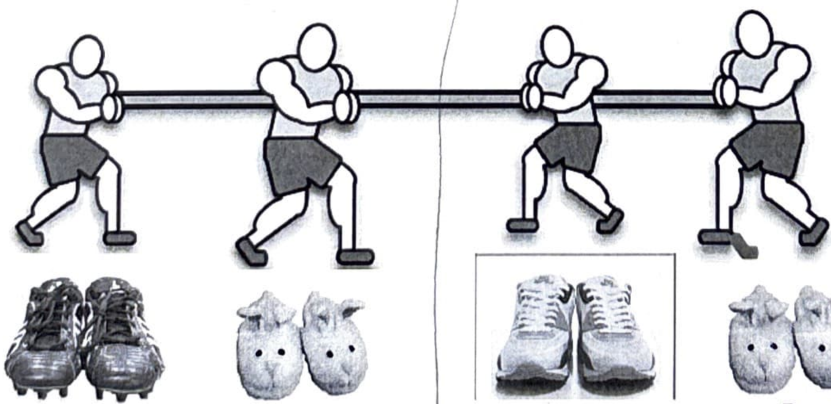
(1800N)(0.7) = 1260N

Mr. Beast
Weight = 1000 N

Markiplier
Weight = 700 N

Dream
Weight = 900 N

Babish
Weight = 1100 N



Cleats
CoF = 0.9

Bunny Slippers
CoF = 0.3

Air Max
CoF = 0.4

Bunny Slippers
CoF = 0.25

(1000N)(0.9) = 900 N

(700N)(0.3) = 210N

(900N)(0.4) = 360N

(1100N)(0.25) = 275N

For each stage of skydiving, determine the drag force, the type of motion present, and which force diagram matches with it.

Stage 1:
The person just jumped out of the plane.

- [ ] Drag bigger than the weight
- [x] Drag smaller than the weight
- [ ] Drag same size as the weight

- [x] Person is speeding up
- [ ] Person is slowing down
- [ ] Person is maintaining speed

Which force diagram below does this match with?

- Diagram A
- Diagram B
- Diagram C
- Diagram D

Stage 2:
The person has been falling for a couple of seconds but hasn't hit terminal velocity yet.

- [ ] Drag bigger than the weight
- [x] Drag smaller than the weight
- [ ] Drag same size as the weight

- [x] Person is speeding up
- [ ] Person is slowing down
- [ ] Person is maintaining speed

Which force diagram below does this match with?

- Diagram A
- Diagram B
- Diagram C
- Diagram D

Stage 3:
The person has been falling for about 10 seconds and has hit terminal velocity.

- [ ] Drag bigger than the weight
- [ ] Drag smaller than the weight
- [x] Drag same size as the weight

- [ ] Person is speeding up
- [ ] Person is slowing down
- [x] Person is maintaining speed

Which force diagram below does this match with?

- Diagram A
- Diagram B
- Diagram C
- Diagram D

Stage 4:
The person just released their parachute.

- [x] Drag bigger than the weight
- [ ] Drag smaller than the weight
- [ ] Drag same size as the weight

- [ ] Person is speeding up
- [x] Person is slowing down
- [ ] Person is maintaining speed

Which force diagram below does this match with?

- Diagram A
- Diagram B
- Diagram C
- Diagram D

Stage 5:
The person's parachute has been released for a couple of seconds, and they are gliding down at terminal velocity.

- [ ] Drag bigger than the weight
- [ ] Drag smaller than the weight
- [x] Drag same size as the weight

- [ ] Person is speeding up
- [ ] Person is slowing down
- [x] Person is maintaining speed

Which force diagram below does this match with?

- Diagram A
- Diagram B
- Diagram C
- Diagram D

Diagram A

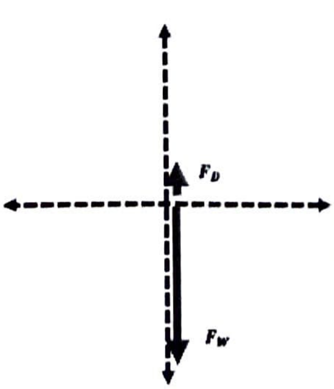


Diagram B

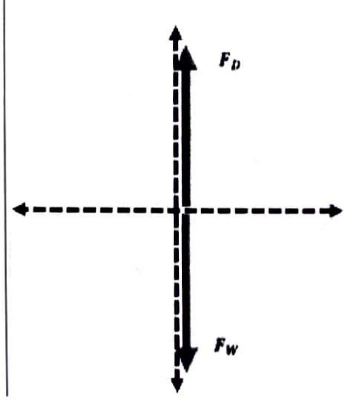


Diagram C

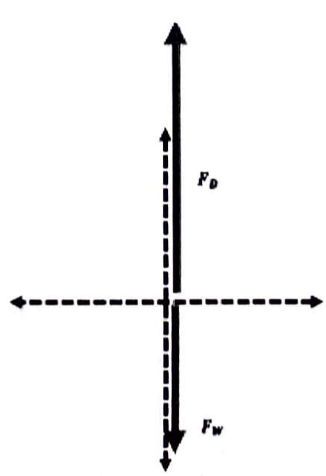
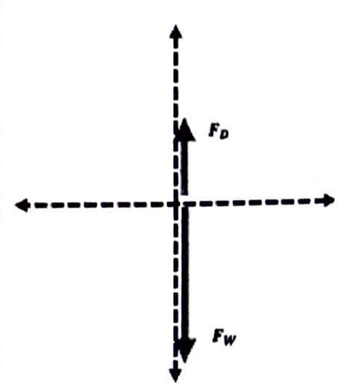


Diagram D



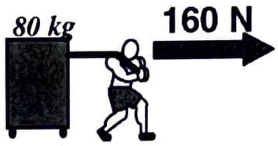
Second Law of Motion Relates Net Force, Mass and Acceleration. What is the equation for finding acceleration if you're given mass and Net Force?

$\frac{\text{F Net}}{\text{mass}}$ = Acceleration

$\frac{200\ N}{50\ kg}$ = 4 m/s/s

speed at start	speed after 1 sec	speed after 2 sec	speed after 3 sec
0 m/s	4 m/s	8 m/s	12 m/s

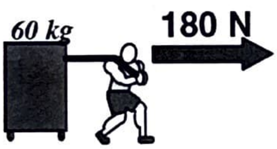
+4 m/s +4 m/s +4 m/s



$\frac{160\ N}{80\ kg}$ = 2 m/s/s

speed at start	speed after 1 sec	speed after 2 sec	speed after 3 sec
1 m/s	3 m/s	5 m/s	7 m/s

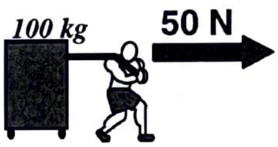
+2 m/s +2 m/s +2 m/s



$\frac{180\ N}{60\ kg}$ = 3 m/s/s

speed at start	speed after 1 sec	speed after 2 sec	speed after 3 sec
2 m/s	5 m/s	8 m/s	11 m/s

+3 m/s +3 m/s +3 m/s



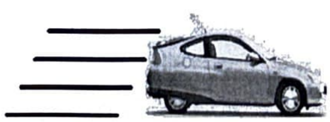
$\frac{50\ N}{100\ kg}$ = 0.5 m/s/s

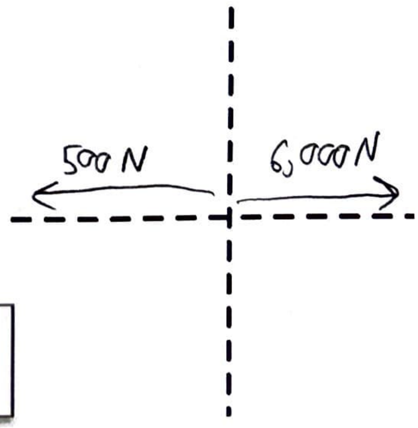
speed at start	speed after 1 sec	speed after 2 sec	speed after 3 sec
1 m/s	1.5 m/s	2 m/s	2.5 m/s

+0.5 m/s +0.5 m/s +0.5 m/s

The car's engine provides 6,000 N of force to the right, but there is 500 N of drag holding it back. The car's mass is 1,100 kg and it weighs 11,000 N.

a) Put all forces on the diagram with arrows.
b) Use the space below to calculate the net force.
c) Use the other spaces to calculate the acceleration.





Net Force Calculation:

6,000 N - 500 N

$\frac{5{,}500\ N}{1{,}100\ kg}$ = 5 m/s/s

What is the Third Law of Motion?

Forces come in Pairs. when you apply a force one way, you get an equal force the other way.

Identify the force pairs present in the following scenarios.

 Guy pushes on a wall — wall Pushes on guy	 Earth pulls on the Moon — moon Pulls on Earth
 Air Pushes bird up Bird takes off by pushing its wings down	 ground Pushes long jumper Long jumper pushes the ground

Conceptual Questions

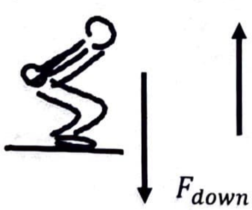
If two objects collide and you see them get equal and opposite accelerations, what does that mean about their masses?

The masses we equal

If two objects collide and they don't get equal and opposite accelerations, what does that mean about their masses? Does it mean that the forces weren't equal and opposite?

The masses were different. The Forces were the same.

If you exert a 400 N force downward on the Earth, how much force does the Earth push you up with?



F_{up} = 400N

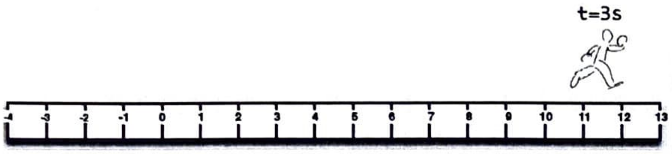
$F_{down} = 400\ N$

The Earth exerts roughly 196,723,511,200,000,000,000 Newtons of force on the Moon to keep it in orbit. How much force does the Moon exert on the Earth?

same amount

196,723,511,200,000,000,000 N

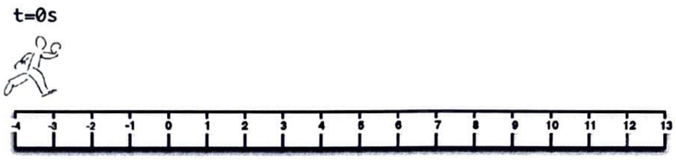
Fill in the unknowns in the tables below!



Their acceleration is +3 m/s/s.

t (s)	x (m)
0	0
1	1
2	5
3	12

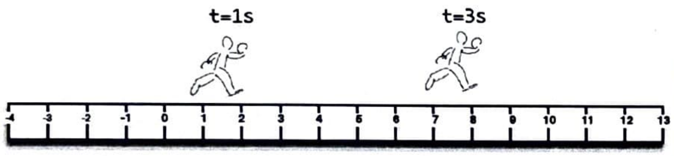
v (m/s)
1
4
7



Their acceleration is -2 m/s/s.

t (s)	x (m)
0	-3
1	4
2	9
3	12

v (m/s)
7
5
3



They are running at a constant velocity.

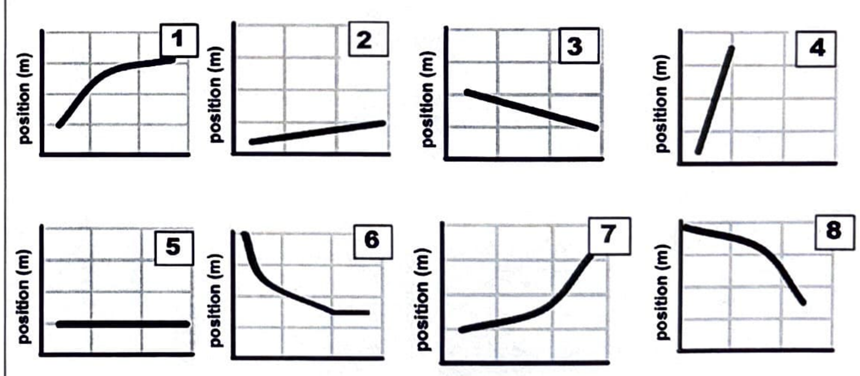
t (s)	x (m)
0	-1
1	2
2	5
3	8

v (m/s)
3
3
3

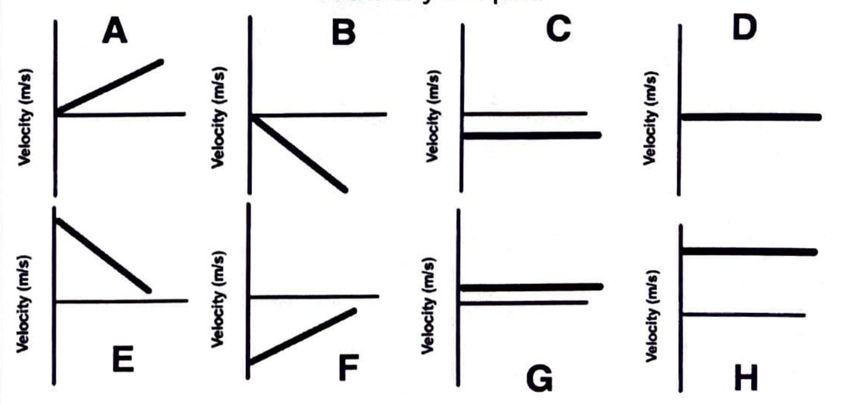
Match the position graph and velocity graph with the description.

- Speed up to the right
  Position Graph 7 Velocity graph A
- Speed up to the left
  Position Graph 8 Velocity graph B
- Slow down to the right
  Position Graph 1 Velocity graph E
- Slow down to the left
  Position Graph 6 Velocity graph F
- Constant speed to the left
  Position Graph 3 Velocity graph C
- Constant speed to the right (slow)
  Position Graph 2 Velocity graph G
- Constant speed to the right (fast)
  Position Graph 4 Velocity graph H
- Stopped
  Position Graph 5 Velocity graph D

Position Graphs

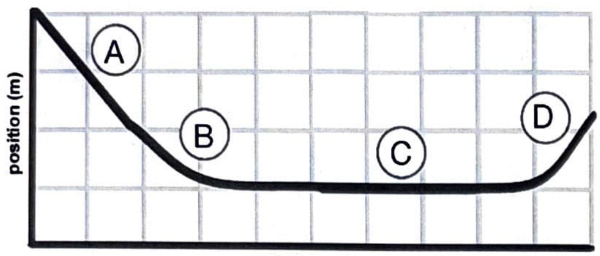


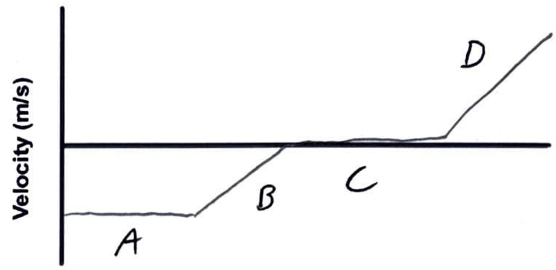
Velocity Graphs



For the position graph below, state what kind of motion is happening and sketch out what it would look like on a velocity graph.

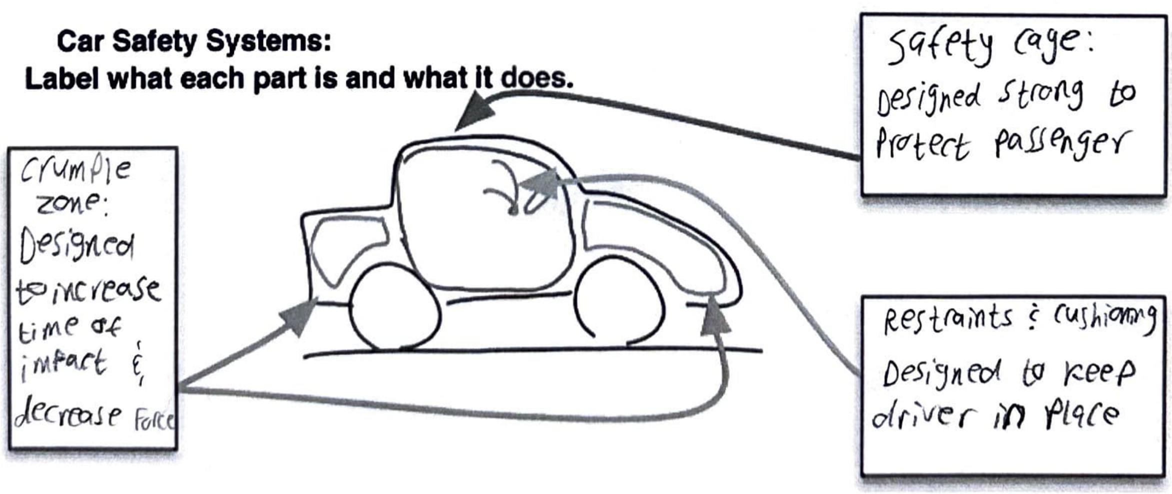
- Stopped
- Constant speed to the right
- Constant speed to the left
- Speed up
- Slow down





A- constant speed to the left
B- slow down
C- stopped
D- speed up

Car Safety Systems:
Label what each part is and what it does.



For the following motion equations, which variable is NOT utilized in each?

	Which variable is NOT utilized?
$V_f = V_i + at$	displacement "d"
$d = V_i t + \frac{1}{2}at^2$	final velocity "V_f"
$d = \frac{(V_f + V_i)}{2}t$	acceleration "a"
$V_f^2 = V_i^2 + 2ad$	time "t"

Fill out the table and determine which equation you would use for each! You DO NOT need to solve it.

d	Vi	Vf	a	t
?	0	60 m/s	X	5 s
Which equation do you use?	$d = \frac{(V_f + V_i)}{2} t$			

A train starting from rest, gets to 60 m/s in 5 seconds.
How far did it travel during this time frame?

d	Vi	Vf	a	t
?	0	X	4 m/s/s	8 s
Which equation do you use?	$d = V_i t + \frac{1}{2} a t^2$			

Gianni is sitting in his car, that starts at rest. The car accelerates at 4 m/s/s for 8 seconds. How much distance did he cover during this time frame?

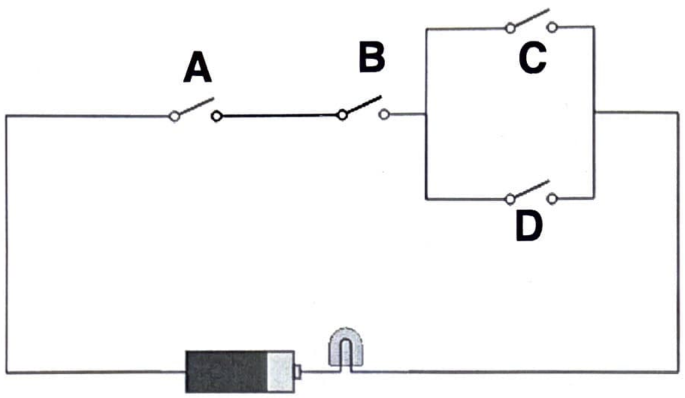
d	Vi	Vf	a	t
X	4 m/s	10 m/s	2 m/s/s	?
Which equation do you use?	$V_f = V_i + at$			

Jamie bikes at a speed of 4 m/s, and then speeds up at a rate of 2 m/s/s, reaching at speed of 10 m/s. How much time did this take?

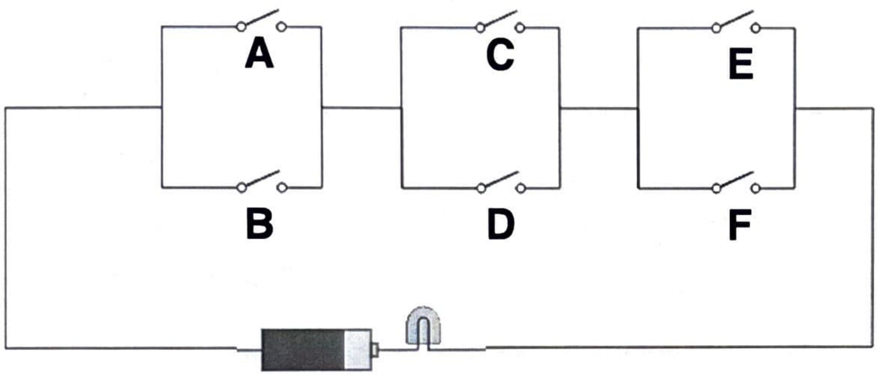
d	Vi	Vf	a	t
45 m	0	?	3 m/s/s	X
Which equation do you use?	$V_f^2 = V_i^2 + 2ad$			

Karen accelerates her car from rest, at a rate of 3 m/s/s, covering 45 meters. What was the speed of the car after it covered this distance?

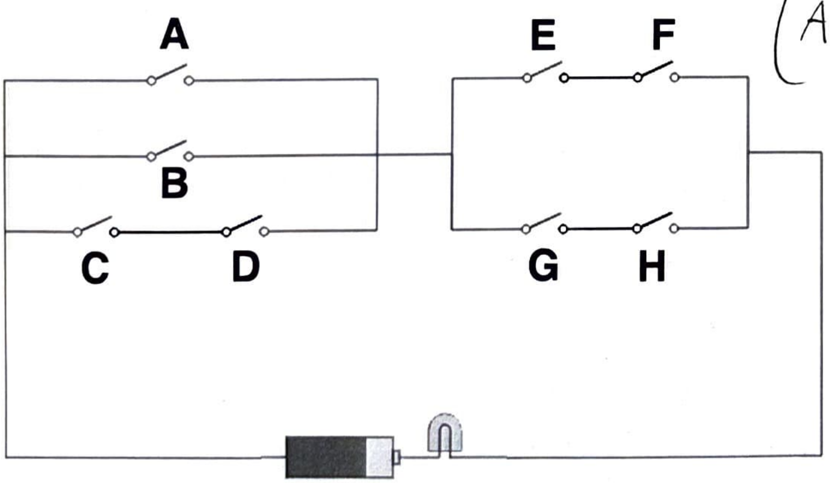
What is the logic statement for the circuits below?



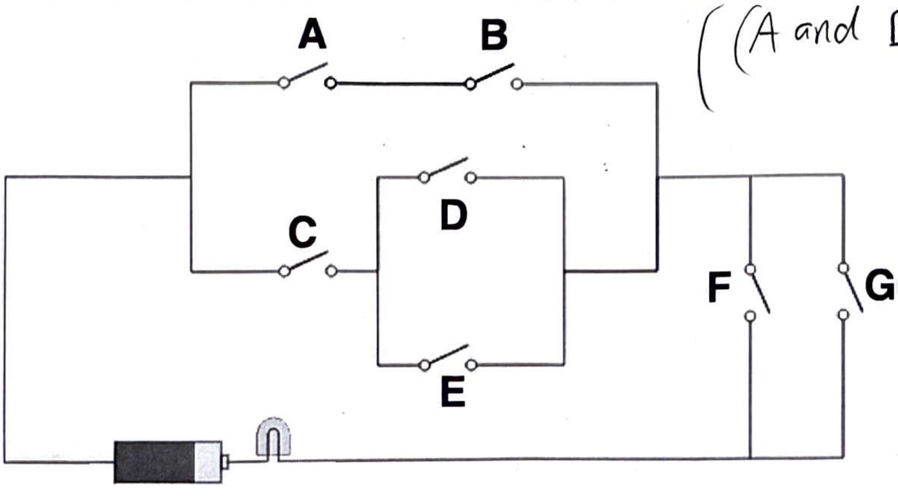
A and B and (C or D)



(A or B) and (C or D) and (E or F)



(A or B or (C and D)) and ((E and F) or (G and H))



((A and B) or (C and (D or E))) and (F or G)