Name: ____ Block: ____

PHYSICS
Forces Practice

Part 1: Forces Vocabulary. Fill in the blank. Neatly print the vocabulary words into the paragraph on the lines.

Acceleration	Inertia	Laws	Pull
Accelerate	Isaac	Mass	Push
Contact	Kilograms	Newtons	Vector

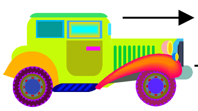
Forces are __________________________________ or __________________________________ interactions between two objects. Forces can be classified as _______________________________ forces or as action-at-a-distance forces. Forces cause objects to _________________________________, or change their states of motions. Force is a _________________________________ because it has a magnitude and a direction. The units of force are _________________________________ named after the famous English scientist _________________________________Newton. Forces are calculated by multiplying _________________________________and _________________________________ together. When calculating forces, the mass must always be in units of _________________________________.

Newton's three ___________________________ of motion describe in detail how forces affect objects and matter. For example, some objects resist accelerating when they are subjected to forces because of the property _________________________________. Objects with greater mass resist accelerating whereas objects with lesser mass accelerate easier.

Part 2: Calculating Forces. Calculate force, acceleration, and mass. **Show all work.** Complete the calculations in the box. Circle your final answer. Use correct units.

- Critically read the problem.
- Identify the important parameters and their units.
- Identify the parameter for which the problem asks to solve.
- Choose the correct equation
- Solve the problem

$$F = m \cdot a \qquad a = \frac{F}{m} \qquad m = \frac{F}{a}$$



$1.33\ m/s^2$

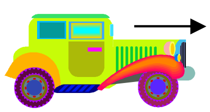
750 kg

1. The motor of a car accelerates a car by $1.33\ m/s^2$. The mass of the car is 750 kg. Calculate the force of the motor causing the car to move. Report your answer in Newtons.

Solve the problem. Show all work.	Your answer

$-1.80\ m/s^2$

750 kg



2. The brakes of a car accelerate the car by $-1.80\ m/s^2$. The mass of the car is 750 kg. Calculate the force of the brakes causing the car to slow. Report your answer in Newtons. The road has no friction.

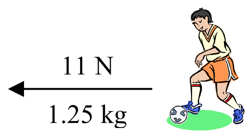
Solve the problem. Show all work.	Your answer

$4.2\ m/s^2$

0.30 kg

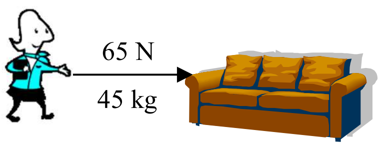
3. Tyrell is an expert archer. Tyrone's bow launches an arrow with an acceleration of $4.2\ m/s^2$. The mass of the arrow is 0.30 kg. Calculate the force of the bow launching the arrow. Report your answer in Newtons.

Solve the problem. Show all work.	Your answer



4. Jorge is a professional soccer player. Jorge kicks the soccer ball with a force of 11 N. The mass of the soccer ball is 1.25 kg. Calculate the acceleration experienced by the soccer ball. Report your answer in m/s^2.

Solve the problem. Show all work.	Your answer



5. Alicia rearranged the furniture in her apartment. She pushed her sofa with a force of 65 N. The mass of her sofa was 45 kg. Calculate the acceleration experienced by the sofa being pushed across the floor. Report your answer in m/s^2. The floor has no friction.

Solve the problem. Show all work.	Your answer

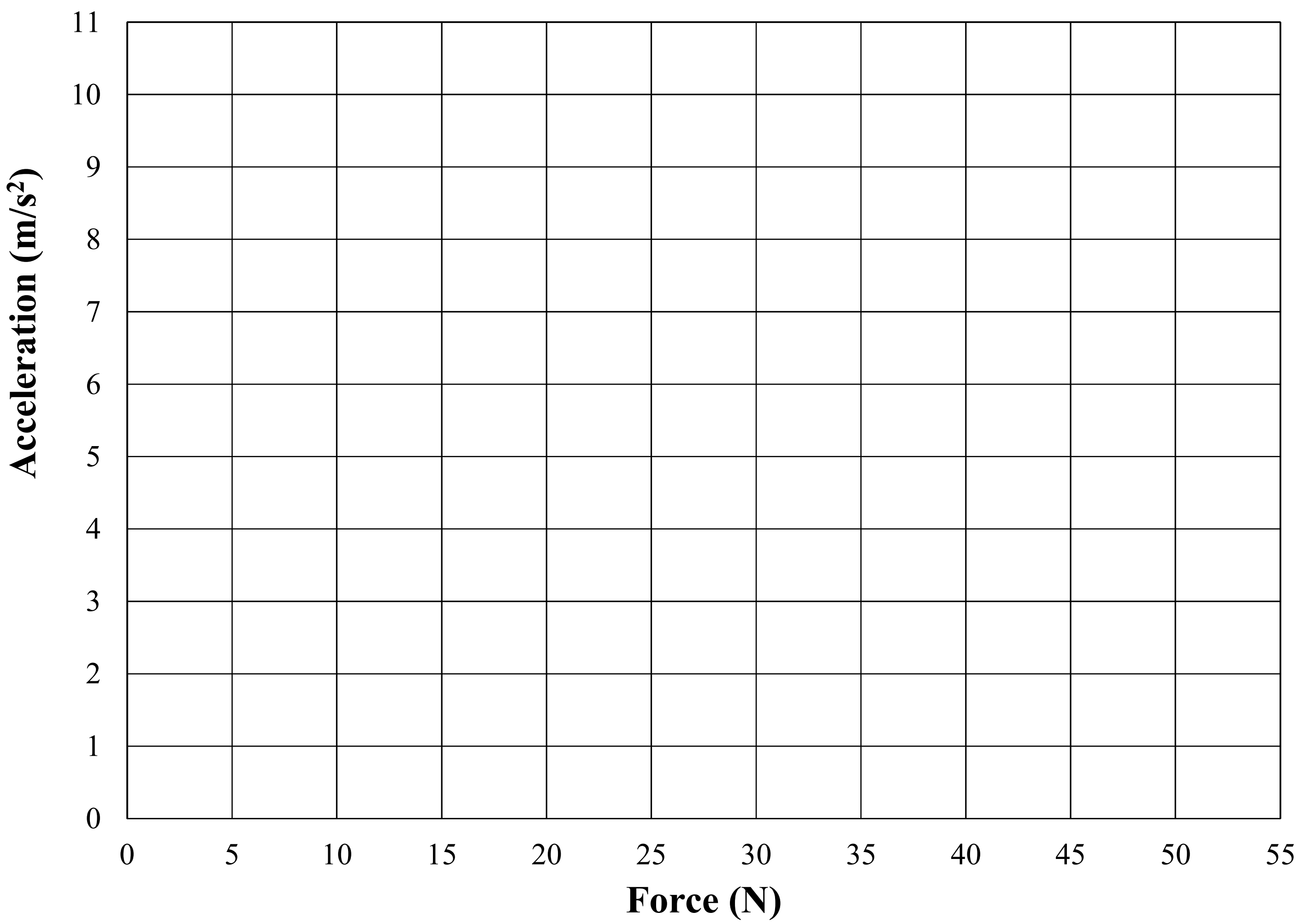
6. A golf ball sits upon a tee. The golf ball is accelerated by 22 m/s^2 after being struck by a driver club. The force of impact was 0.88 N. Calculate the mass of the golf ball. Air resistance is very small.

Solve the problem. Show all work.	Your answer

Part 3. Graphing acceleration

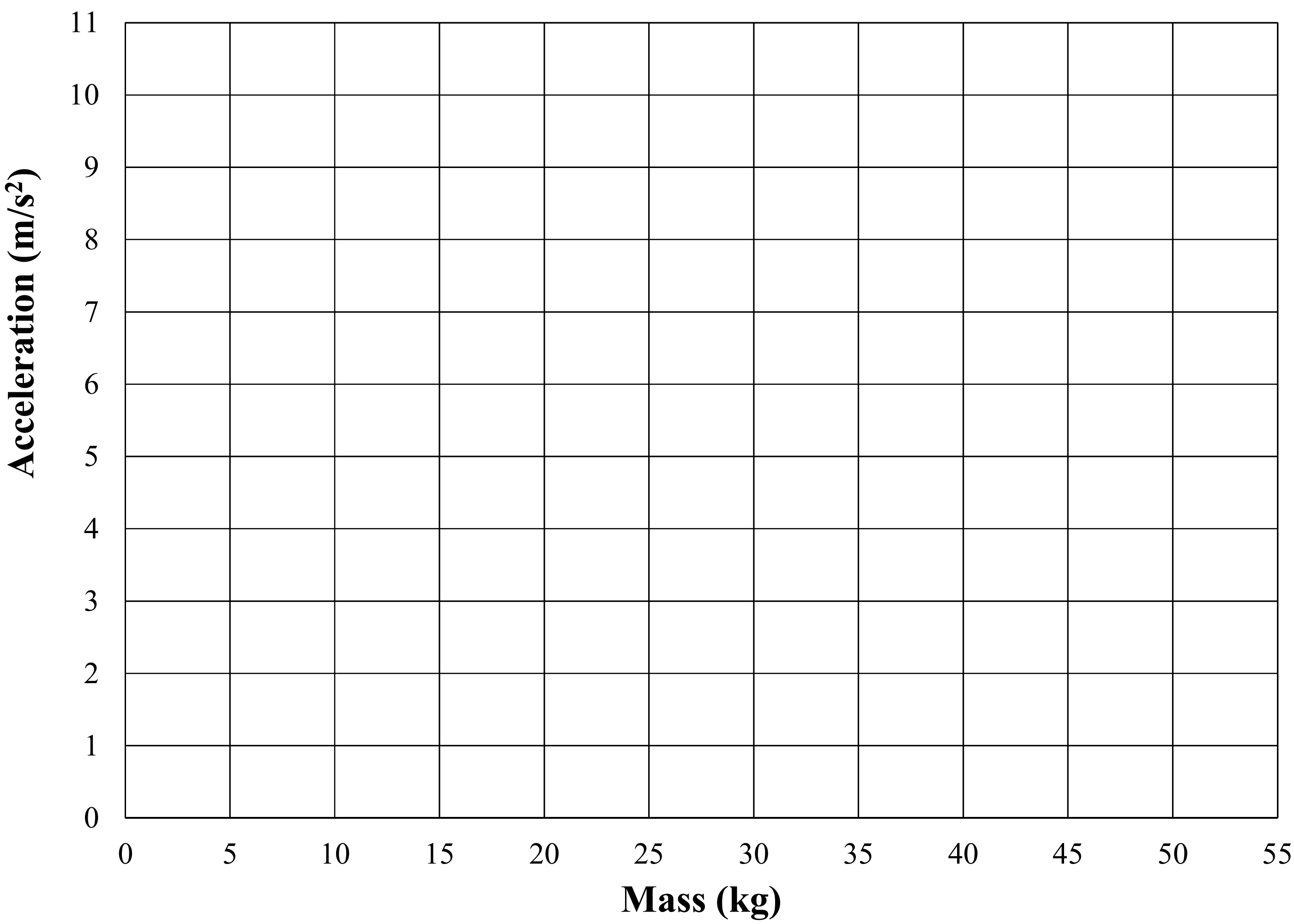
#1. The mass of the object remains constant and the force causing the acceleration increases. Calculate the acceleration of the object. Plot the acceleration data as points on the graph. Draw one curving best-fit line through the data points. $a = \frac{F}{m}$

Force (N)	0	5	10	15	20	25	30	35	40	45	50
Mass (kg)	5	5	5	5	5	5	5	5	5	5	5
Accel (m/s²)											



#2. The force causing the acceleration remains constant and mass increases. Calculate the acceleration of the object. Plot the acceleration data as points on the graph. Draw one curving best-fit line through the data points. $a = \frac{F}{m}$

Force (N)	10	10	10	10	10	10	10	10	10	10	10
Mass (kg)	1	2	4	6	8	10	15	20	30	40	50
Accel (m/s²)											



Part 4: Newton's Laws Vocabulary. Fill in the blank. Neatly print the vocabulary words into the paragraph on the lines.

Acceleration	Force	Mass	Opposite
Decreases	Increases	Motion	Rest
Equal	Inertia	Newton	Unbalanced

The English scientist Sir Isaac ________________________ developed three laws of motion. The 1^{st} Law of Motion is called the "law of ________________________". This law states that objects in motion will remain in __________________________and objects at rest will remain at __________________________ unless acted upon by an ________________________ __________________________. The 2^{nd} Law of Motion states that the ________________________ experienced by an object is proportional to the force and inversely proportional to the object's __________________________. This means that as more unbalanced force is applied to an object, its acceleration __________________________. It also means that as an object's mass increases, the acceleration __________________________ for a given unbalanced force. The 3^{rd} Law of Motion states that for every force there is an __________________________, but _____________________________ force. This means that whenever one object pushes on another object, the other object pushes equally hard back.

Part 5: Multiple Choice. Write the letter of the correct answer on the line to the left of the question or statement. Some statements are generalizations or misconceptions about Newton's laws, and do not have a correct answer.

__________ 1 The more mass an object has, the more force required to accelerate the object.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 2 What goes up, eventually must go down.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 3 Eventually all objects at rest will be put into motion.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 4 The acceleration experienced by an object is proportional to the force causing the acceleration and inversely proportional to the mass of the object.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 5 If two objects interact, the force exerted by one object is equal to and opposite the force exerted by the other object.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 6 An object in motion wants to keep moving in a straight line at a constant velocity.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 7 Objects affected by unbalanced external forces will have a change in its original state of motion.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 8 Eventually all objects in motion will come to a rest.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 9 You have two magnets. You place the south pole of one magnet near the north pole of the other magnet. The magnets quickly move toward each other.
A. 1st Law B. 2nd Law C. 3rd Law D. None

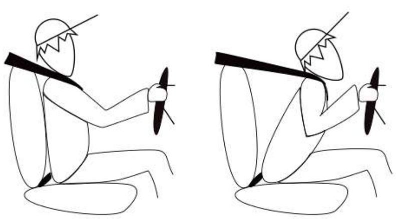
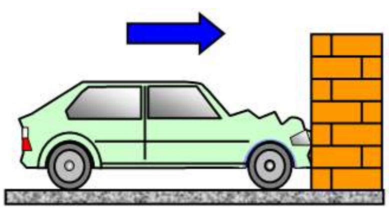
__________ 10 Two objects collide head-on. The object lesser mass is bounced a greater distance, the object with the greater mass is bounced a shorter distance after the collision.
A. 1st Law B. 2nd Law C. 3rd Law D. None

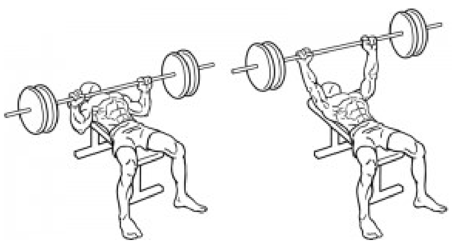
__________ 11 You ride in a car. The car makes a sharp left turn. Your body leans to the right as the car turns.
A. 1st Law B. 2nd Law C. 3rd Law D. None

__________ 12 A rocket's booster fires. The hot air expelled by the rocket booster pushes against the ground, thus pushing the rocket into the air.
A. 1st Law B. 2nd Law C. 3rd Law D. None

Part 6: Newton's Laws of Motion

Study the ten images in the left column. In the right column, identify which of Newton's laws of motion applies, and write one complete sentence that justifies why that law applies.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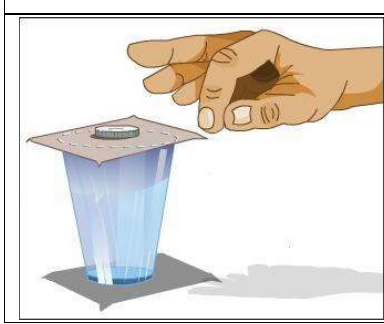
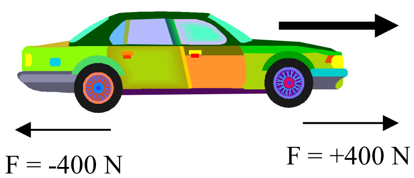
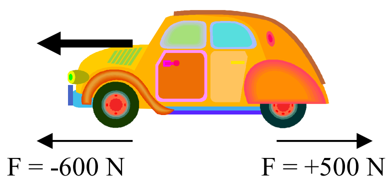
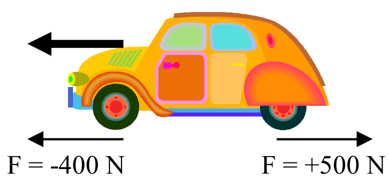
	

Part 7. Friction, Balanced and Unbalanced Forces. Look at the diagram. The heavy black arrow points in the direction of the car's motion. The force vector arrows show the direction of the forces acting upon the cars. Friction force is in the direction opposite of the car's motion.

	Are forces balanced or unbalanced? Which force is greater: applied force or friction force?	Calculate the Net Force	Does the object speed up, slow down, change direction, or move at same velocity with time?
			
			
			

Part 8: Drawing 2-dimensional Free Body Diagrams. Neatly draw the free body diagram using vectors. Represent the free body as a square. The vector arrows must be proportional in length to the magnitude. Write the magnitude next to the vector arrow. The initial velocity of the free body is provided for you.

1. 40 N south, 30 N north, 10 N north. Object is moving north at 10 m/s.	**2.** 25 N west, 25 N east, 15 N east. Object is moving west at 20 m/s.

3. 20 N north, 35 N west. Object is motionless, 0 m/s.	**4.** 10 N west, 25 N west, 50 N south, 10 N north, 40 N. Object is moving west at 10 m/s.

Look at the free body diagrams you drew 1, 2, 3, 4. Answer the questions below.

FBD	Are forces balanced or unbalanced?	Calculate the Net Force	In which direction is the acceleration?	Will the object get faster, get slower, remain motionless, or change direction?
1.				
2.				
3.				
4.				