Physics 12 **Momentum Assignment 2022** **Name:_____**

Momentum Formulas: $\boldsymbol{p = mv}$ Impulse: $\Delta \boldsymbol{p} = \boldsymbol{F}\Delta \boldsymbol{t} = \boldsymbol{m}\Delta \boldsymbol{v}$

Law of Conservation of Momentum: $\sum \boldsymbol{p_i} = \sum \boldsymbol{p_f}$ **Mark:_____/____**

Part 1) 1D Momentum and Impulse

1.	a) What is the momentum of a 400 kg cart travelling at 15 km/h? momentum _____ b) How fast is a 1.50 kg ball moving if it has a momentum of 4.50 kg.m/s? velocity _____
2.	A 5.00 kg ball accelerates at a rate of $2.00\ \mathrm{m/s^2}$ for 1.50 seconds. Calculate the ball's momentum after the acceleration. momentum _____
3.	a) A force of 20.0 N is applied to a 3.00 kg object for 4.00 seconds. Calculate the impulse experienced by the object. Impulse _____ b) A 1200 kg car traveling at 20.0 m/s speeds up to 30.0 m/s. What is the impulse experienced by the car? Impulse _____
4.	Two billiard balls, each of mass 565g, approach each other, one with speed of 2.3m/s and the other with a speed of 4.5m/s. After the collision, the one that was travelling faster reverses its direction and travels at 2.3 m/s. What is the velocity of the other ball? Velocity _____
5.	A child's ball of mass 560g rolls along the ground at 7.6m/s towards a stationary bowling ball of mass 4.5kg. After the collision, the bowling ball travels at 1.5m/s. What is the velocity of the child's ball? Velocity _____

6.	A 1500 kg car traveling at 80.0 km/h comes to a screeching halt in a time of 4.00 seconds. Calculate the force of friction experienced by the car. Force _____
7.	A 1500 kg car travelling at 24m/s slows to a stop and reverses uniformly to 4 m/s. If the action taken by the driver takes 7.0 seconds to complete a) What was the car's change in momentum (Impulse)? b) What was the average force exerted on the car? a) _____ b) _____
8.	A 230 kg sled travelling at 3.4 m/s to the right hits a stationary 35 kg girl. The girl ends up on the sled. With what speed will the sled move off at? Speed _____
9.	A 3500 kg boxcar travelling at 5.0 m/s West runs into a stationary 4500 kg boxcar. They couple (stick) together and move off down the track. How fast will they be going immediately after the collision? Speed _____
10.	A 75.0 kg man is standing at rest on ice while holding a 4.00 kg ball. If the man throws the ball at a velocity of 3.50 m/s forward, what will his resulting velocity be? Velocity _____

Part 2) 2D Momentum & Impulse

Conservation of Momentum in 2D: $\sum \boldsymbol{p_{xi}} = \sum \boldsymbol{p_{xf}}$ $\sum \boldsymbol{p_{yi}} = \sum \boldsymbol{p_{yf}}$ **Impulse** $= \Delta \boldsymbol{p} = \boldsymbol{F}\Delta \boldsymbol{t}$

11.	A 1100 kg car is traveling at 15 m/s 24° [E of N] when it collides with a 1450 kg truck traveling at an unknown angle [W of N]. After the collision both vehicles stick together and travel due North at 9.0 m/s. What was the magnitude and direction of the truck's initial velocity? V)_____ direction)_____
12.	A 1375 kg car traveling 18 m/s West turns a corner and travels North at 15 m/s. The turn takes a total of 3.6 s. a. Find the magnitude and direction of the car's impulse. b. Determine the average net force acting on the car during the turn. Impulse)_____ dir)_____ b)_____ dir)_____

13.	Two balls are involved in a glancing collision. Before the collision, the first ball (3 kg) is moving at a velocity of 1.00 m/s East and the second ball (2 kg) is at rest. After the collision, the first ball is moving at a speed of 0.550 m/s [24.0° S of E]. The second ball heads off at an unknown angle. What is the Velocity of the second ball after the collision? Velocity) _____ Dir) _____
14.	A 4.0 kg object initially at rest explodes into 3 unequal fragments. A 1.2 kg chunk flies off at 15 m/s 30° [N of W] and a 0.9 kg chunk moves at 18 m/s 10° [E of N]. Find the magnitude and direction of the velocity of the final piece. vel)_____ dir)_____