

First Name: _____ Last Name: _____

24 - Worksheet - Buffer Day - Cumulative Review **159 marks**

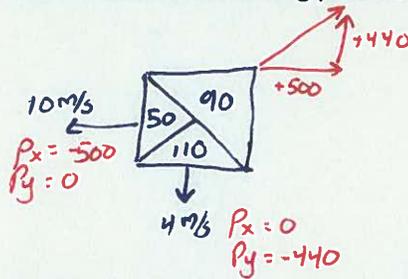
Unit 1 - Momentum and Impulse ___ / 13 marks

Use the following information to answer Q1:

A hole is drilled in a boulder that has a mass of 250.0kg. An explosive charge is placed in the hole. The boulder explodes into three main pieces that have masses of 110.0kg, 50.0kg, and 90.0kg. The 110.0kg piece and the 50.0kg piece fly off at right angles to each other at speeds of 4.00 m/s and 10.00 m/s, respectively.

Q1: The magnitude of the momentum of the 90.0kg piece is

- a) 7.40 kg*m/s
- b) 60.0 kg*m/s
- c) 666 kg*m/s
- d) 940 kg*m/s



$a^2 + b^2 = c^2$
 $|\vec{p}_f| = 666.033032214 \text{ kg m/s}$

Q2: In an inelastic collision, the energy that appears to be missing is converted into

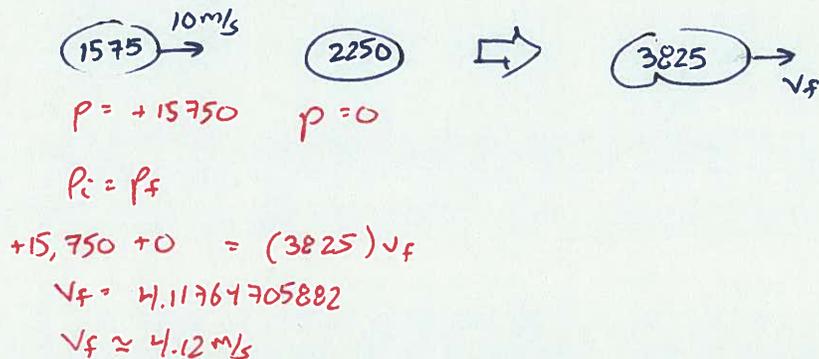
- a) sound and momentum
- b) force and momentum
- c) sound and heat
- d) heat and force

Force is not an energy type.
 Momentum is not an energy type.

Q3: A 1575kg car, initially travelling at 10.0 m/s, collides with a stationary 2250kg car. The bumpers of the two cars become locked together. The speed of the combined cars immediately after impact is _____ m/s.

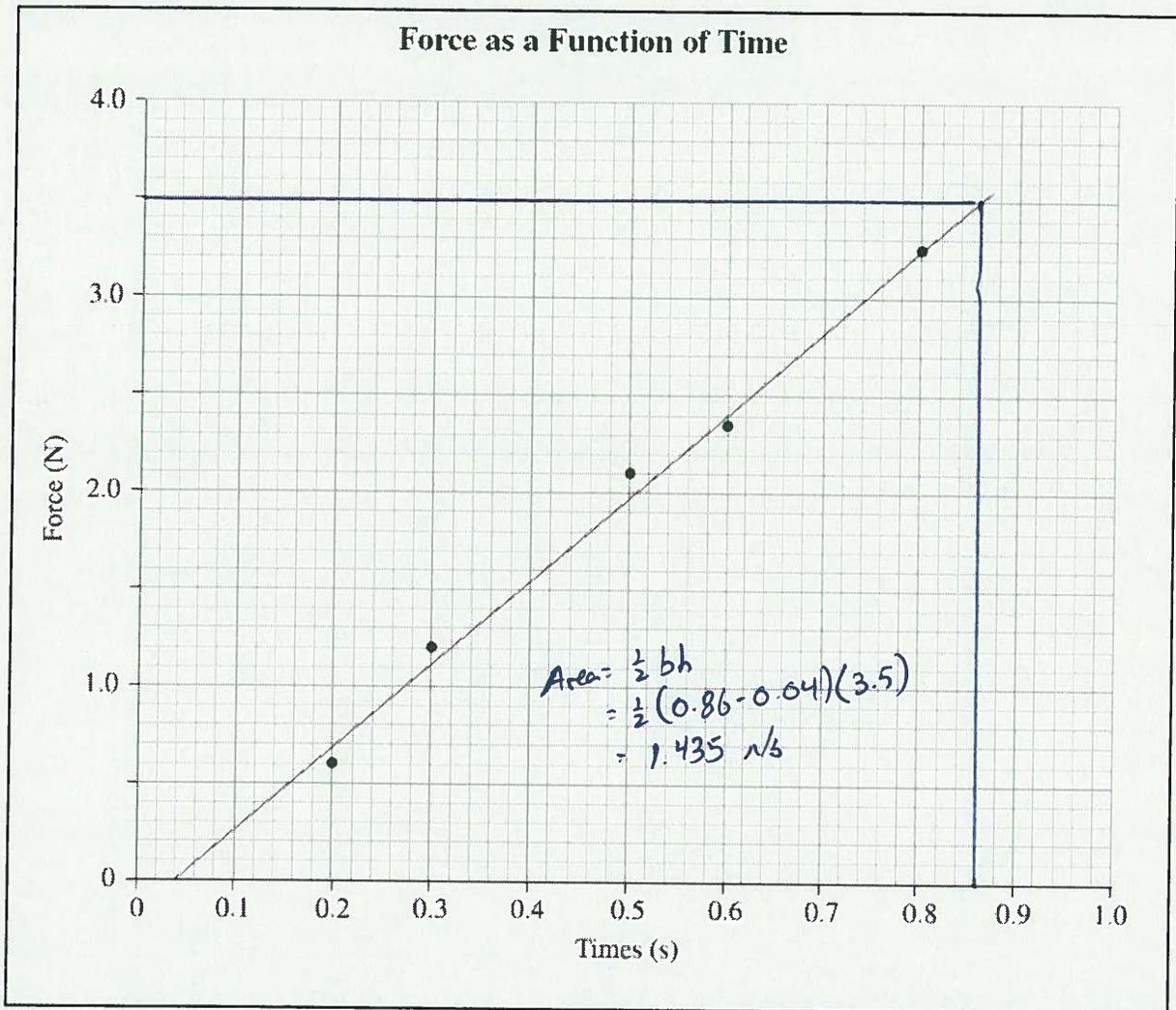
(Record your four digit answer in the Numerical Response boxes below)

4	.	1	2
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KEY

Use the following information to answer Q4-Q5:



Q4: The physics significance of the area under the line of best fit from $t = 0.04\text{s}$ to $t = 0.86\text{s}$ is

- a) impulse \rightarrow Area under a $F-t$ graph
- b) work done \rightarrow Area under a $F-d$ graph (Phys20 concept)
- c) momentum
- d) change in impulse

Q5: If the mass of the object was 0.500 kg and it started from rest, then the object's final speed at the end of 0.86s would be _____ m/s .

(Record your **four digit** answer in the Numerical Response boxes below)

2 . 8 7

$$F \Delta t = m \Delta v$$

$$1.435 = (0.5) \Delta v$$

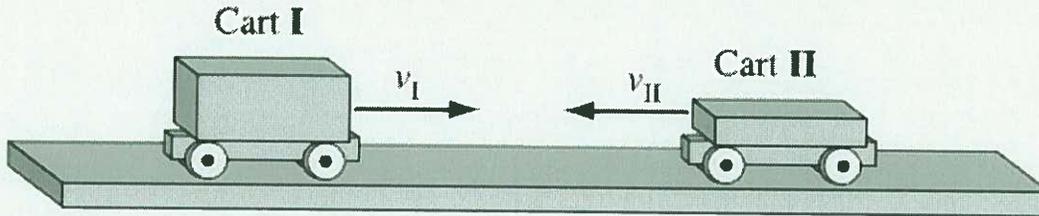
$$\Delta v = 2.87 \text{ m/s}$$

$$\text{If } v_i = 0 \text{ m/s, then } v_f = 2.87 \text{ m/s}$$

Use the following information to answer Q6:

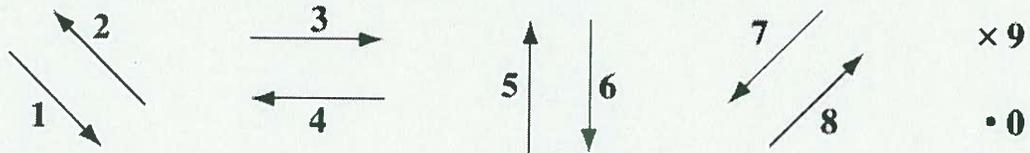
Two carts, travelling at the same initial speed, move toward each other on a table, as shown below. Cart I has a total mass of 500 g and Cart II has a total mass of 250 g.

Side View of Colliding Carts



The carts collide. After contact, the carts remain separate from each other and move independently.

Directions



Relative Sizes

- 1 Twice as large
- 2 Same size
- 3 Half as large

Q6: For the time interval when the two carts are in contact, match the directions and relative sizes as numbered above with the descriptions given below.

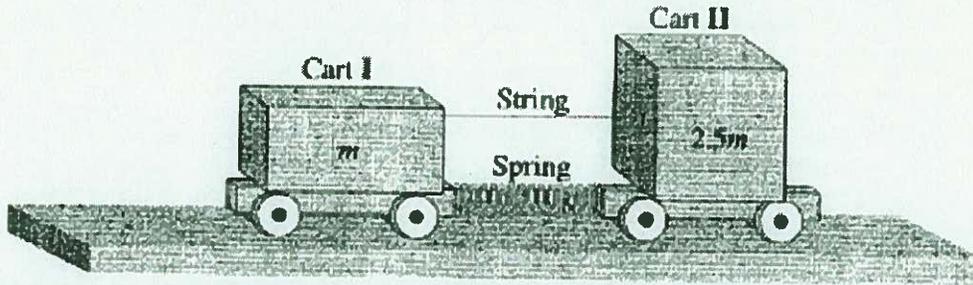
<p>Number:</p> <p>Description:</p>	<p>$\leftarrow 4$</p> <p>Direction of the force of Cart II on Cart I</p>	<p>$\leftarrow 4$</p> <p>Direction of the impulse of Cart I</p> <p><i>Impulse = $F\Delta t$</i> <i>= $m\Delta v$</i></p>	<p><i>Same F, same Δt, 2</i></p> <p>Magnitude of the impulse of Cart I compared to Cart II</p>
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(Record your **four digit** answer in the Numerical Response boxes below)

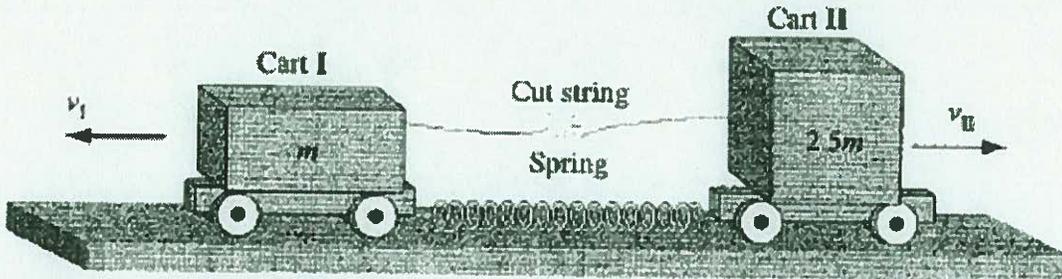
4	4	2	
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Use the following information to answer Q7:

Two laboratory carts are placed on a frictionless surface. A spring is attached to both carts and compressed. A string holds the two carts together so that they are motionless. Cart I has a mass of m and cart II has a mass of $2.5m$.



The string is cut and the carts move in opposite directions; cart I has a velocity of 0.80 m/s , left.



Q7: The speed of cart II after the string is cut is

- a) 3.1 m/s
- b) 2.0 m/s
- c) 0.80 m/s
- d) 0.32 m/s

First, if this question is difficult, assign a value to mass. You could say $m = 1 \text{ kg}$ to really simplify things, if you wished.

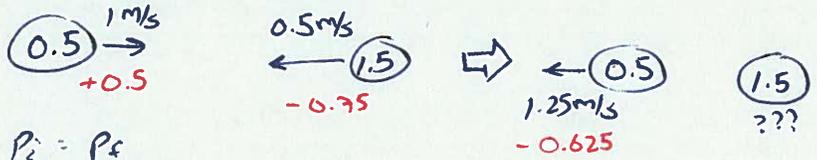
$$\begin{aligned}
 p_i &= p_f \\
 0 &= -(m)(0.8) + (2.5m)v_f \\
 0.8m &= 2.5m v_f \\
 \div 2.5m & \quad \div 2.5m \\
 0.32 \text{ m/s} &= v_f
 \end{aligned}$$

Use the following information to answer Q8-Q9:

A 0.50 kg mass is travelling 1.00 m/s [East] when it collides with a 1.50 kg mass travelling 0.50 m/s [West]. Immediately after the collision the 0.50 kg mass is travelling at 1.25 m/s [West].

Q8: What is the final velocity of the 1.50 kg mass after the collision?

- a. 0.25 m/s [East]
- b. 0.25 m/s [West]
- c. 1.75 m/s [East]
- d. 1.75 m/s [West]



$$P_i = P_f$$

$$(+0.5) + (-0.75) = (-0.625) + P_f$$

$$+0.375 = P_f$$

$$V_f = +0.25 \text{ m/s [East]}$$

Q9: Which of the following statements is correct?

- a. Momentum is conserved and the collision is inelastic.
- b. Momentum is conserved and the collision is elastic.**
- c. Momentum is not conserved and the collision is inelastic.
- d. Momentum is not conserved and the collision is elastic.

Momentum is conserved.

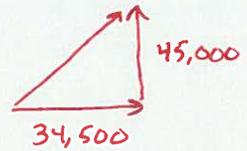
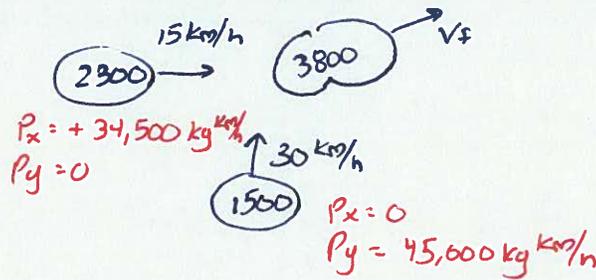
E_{Ki}	$\frac{vs}{\rightarrow}$	E_{Kf}
$\frac{1}{2}(0.5)(1)^2 + \frac{1}{2}(1.5)(0.5)^2$	$\frac{vs}{\rightarrow}$	$\frac{1}{2}(0.5)(1.25)^2 + \frac{1}{2}(1.5)(0.25)^2$
0.25 + 0.1875	$\frac{vs}{\rightarrow}$	0.390625 + 0.046875
0.4375 J	$\frac{vs}{\rightarrow}$	0.4375 J

Kinetic energy is conserved \rightarrow Elastic!

KEY

Q10: A 1.50×10^3 kg car travelling at 30.0 km/h [North] collides with a 2.30×10^3 kg truck travelling at 15.0 km/h [East]. The vehicles stick together and travel together after the impact. How fast are the vehicles travelling together immediately after the impact?

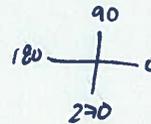
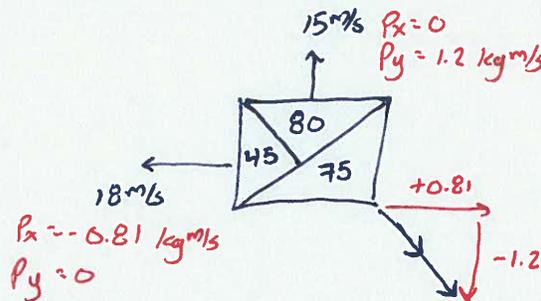
- a. 14.92 km/h
- b. 22.76 km/h
- c. 28.78 km/h
- d. 45.0 km/h



$a^2 + b^2 = c^2$
 $p_f = 56,703 \text{ kg km/h}$
 $v_f = 14.92 \text{ km/h}$

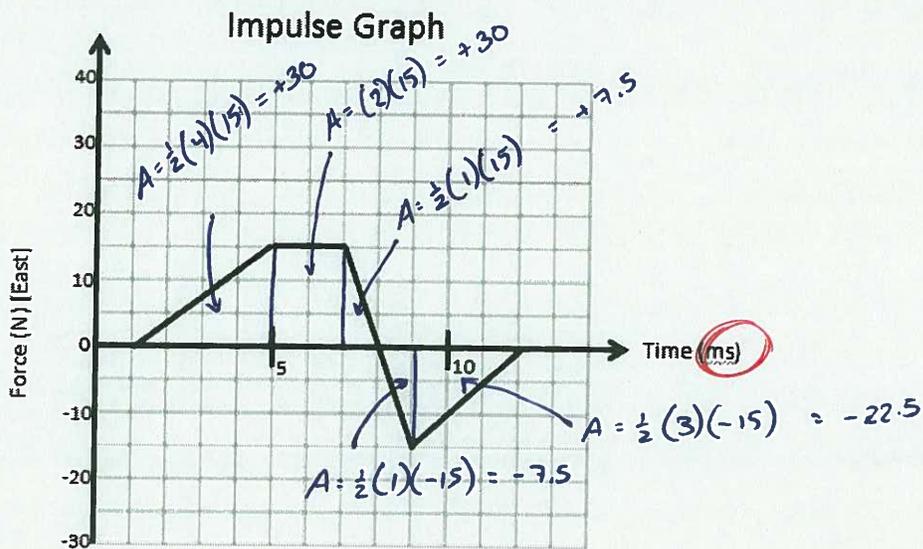
Q11: A stationary 200.0g firework explodes into three pieces. The first 80.0 g piece travels at 15m/s [90°], the second 45.0 g piece travels at 18.0 m/s [180°]. What is the speed of the third piece?

- a. 1.45 m/s
- b. 6.28 m/s
- c. 19.3 m/s
- d. 23.4 m/s



$a^2 + b^2 = c^2$
 $p_f = 1.44779142144 \text{ kg m/s}$
 $v_f = 19.3 \text{ m/s}$

Use the following graph to answer Q12:



Q12: An object of mass 15kg experiences a varying force, as depicted above. The total impulse the object experiences is $a.bc \times 10^{-d}$ kg m/s. The values of a , b , c , and d are __, __, __, and __.

(Record your **four digit** answer in the Numerical Response boxes below)

3	7	5	2
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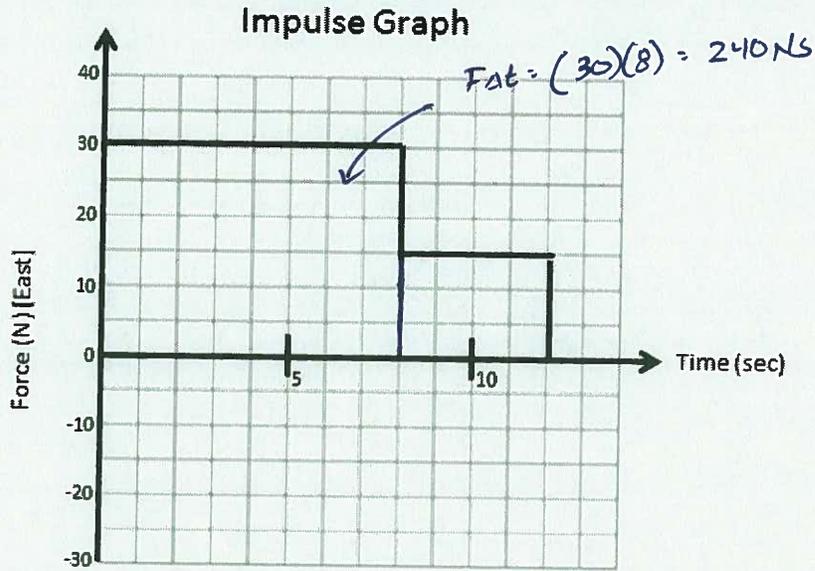
$$F_{at} = +30 + 30 + 7.5 - 7.5 - 22.5 = 37.5 \text{ Ns}$$

Hold on... that doesn't fit the numerical response format! Check axis!

$$F_{at} = 0.0375 \text{ Ns} \approx 3.75 \times 10^{-2} \text{ Ns}$$

Use the following information to answer Q13:

The graph below depicts the forces acting on an initially stationary 3kg mass.



Q13: What is the velocity of the 3kg mass at 8 seconds?

- a. 10 m/s
- b. 80 m/s
- c. 120 m/s
- d. 240 m/s

$$F_{at} = m \Delta v$$

$$240 = (3) \Delta v$$

$$\Delta v = 80 \text{ m/s}$$