ENERGY AND MOMENTUM

PROVINCIAL EXAM ASSIGNMENT

Energy: **MC:** 4-6, 11, 15, 20, 21, 26-28, 301-6, 8, 10, 12, 13,
WR: 1, 6, 10

Momentum: **MC:** 1-3, 7-10, 12-14, 16-19, 22, 23, 25, 29, 31-33
WR: 2, 4, 5, 7-9, 11, 12

Note: A number of the momentum questions include energy concepts and cannot be solved until both concepts are understood.

1. A puck sliding on a frictionless table undergoes a change in momentum due to a constant force. Which of the following expressions could be used to determine the change in momentum?

   A. $F \times \Delta d$
   B. $F \times \Delta t$
   C. $F \times \Delta v$
   D. $F \times (\Delta v / \Delta t)$

2. A 2.0 kg puck travelling due east at 2.5 m/s collides with a 1.0 kg puck travelling due south at 3.0m/s. They stick together on impact. What is the resultant direction of the combined pucks?

   A. 31° S of E
   B. 40° S of E
   C. 50° S of E
   D. 59° S of E

3. Impulse is measured in which units?

   A. J
   B. N
   C. $N \cdot m$
   D. $N \cdot s$

4. How much work must be done to stop an 1 800 kg vehicle travelling at 30 m/s?

   A. 1.8×10^4 J
   B. 5.4×10^4 J
   C. 5.3×10^5 J
   D. 8.1×10^5 J

5. Work is measured in which units?

   A. J
   B. N
   C. J/s
   D. $N \cdot s$

6. What is the minimum power developed by a 75 kg person who climbs a set of stairs 4.5 m high in 5.0 s?

   A. 6.8×10^1 W
   B. 6.6×10^2 W
   C. 1.7×10^3 W
   D. 3.3×10^3 W

7. Two carts collide while travelling on a smooth surface. It is found that the sum of the kinetic energies of the carts after the collision is the same as before the collision. This collision **must** be

A. elastic.
B. inelastic.
C. between carts of identical mass.
D. between carts that stick together.

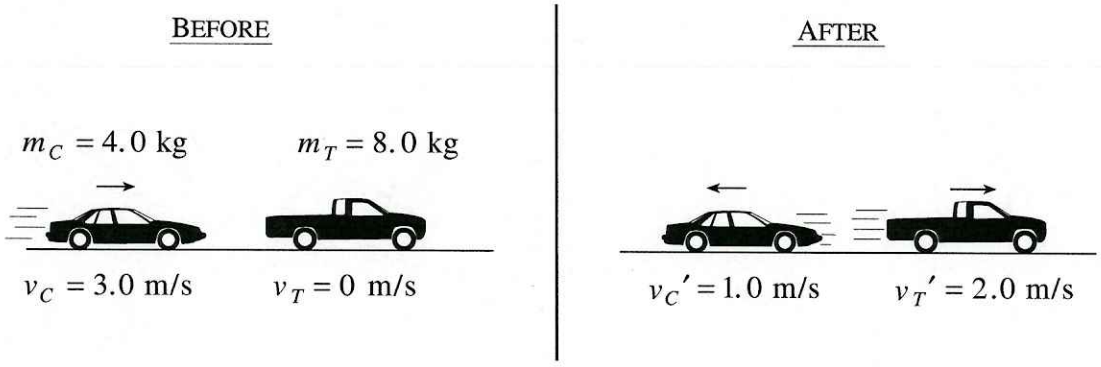
8. A 0.15 kg ball moving at 40 m/s is struck by a bat. The bat reverses the ball's direction and gives it a speed of 50 m/s. What average force does the bat apply to the ball if they are in contact for 6.0×10^{-3} s?

A. 14 N
B. 2.5×10^{2} N
C. 1.3×10^{3} N
D. 2.3×10^{3} N

9. In order to stop two sliding objects, the greater impulse **must** be given to the one having the greater

A. mass.
B. speed.
C. velocity.
D. momentum.

10. The diagram shows a collision between a 4.0 kg toy car and a stationary 8.0 kg toy truck. After the collision, the car bounces back at 1.0 m/s while the truck goes forward at 2.0 m/s. **Based on these values**, are momentum and kinetic energy conserved?



	MOMENTUM	KINETIC ENERGY
A.	Conserved	Conserved
B.	Conserved	Not Conserved
C.	Not Conserved	Conserved
D.	Not Conserved	Not Conserved

11. As a skier descends a slope, her kinetic energy increases from 600 J to 3 200 J while her gravitational potential energy decreases by 5 900 J. How much heat energy is created due to friction?

A. 2 100 J
B. 3 300 J
C. 8 500 J
D. 9 700 J

12. Which expression is equal to the net force on an object?

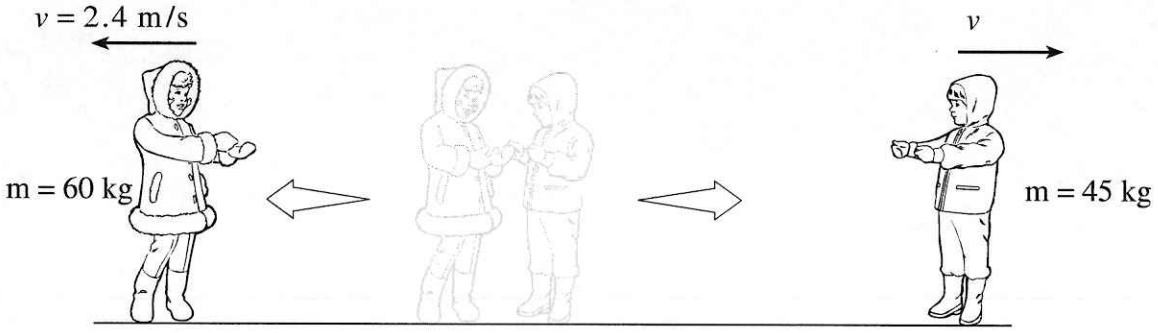
A. $\frac{\Delta p}{\Delta t}$

B. $\frac{W}{\Delta t}$

C. $m\Delta v$

D. ΔE

13. A 60 kg girl and her 45 kg brother are at rest at the centre of a frozen pond. He pushes her so that she slides away at 2.4 m/s. How much total work is done? (Ignore friction.)



A. 58 J
B. 170 J
C. 350 J
D. 400 J

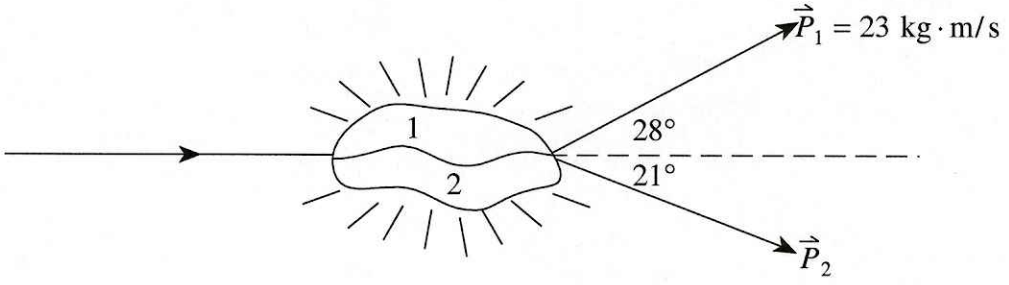
14. Impulse is defined as

A. total energy.
B. total momentum.
C. a change in energy.
D. a change in momentum.

15. Calculate the minimum power of a cyclist who can increase his kinetic energy from 480 J to 2 430 J by travelling 26 m in 4.0 s.

A. 75 W
B. 3.6×10^2 W
C. 4.9×10^2 W
D. 7.3×10^2 W

16. A small explosive device sliding to the right breaks into two pieces. The momentum of fragment **1** after the explosion is 23 kg · m/s.



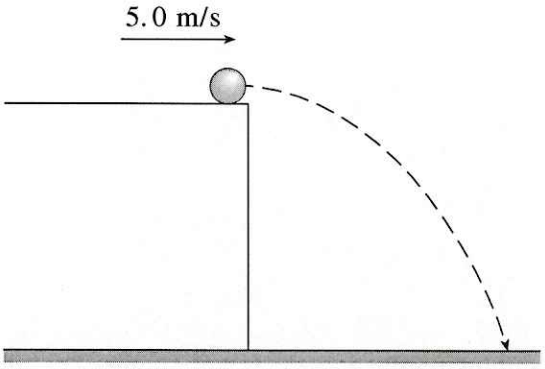
What is the momentum of fragment **2** after the explosion?

A. 22 kg · m/s
B. 23 kg · m/s
C. 30 kg · m/s
D. 32 kg · m/s

17. Which set of conditions is true in all inelastic collisions?

	MOMENTUM	KINETIC ENERGY	TOTAL ENERGY
A.	Conserved	Conserved	Conserved
B.	Conserved	Not conserved	Conserved
C.	Not conserved	Not conserved	Conserved
D.	Not conserved	Conserved	Not conserved

18. A 0.30 kg ball rolls off a horizontal surface as shown in the diagram. What is the magnitude of the impulse given to the ball by gravity during the 0.90 s it takes the ball to fall to the ground?

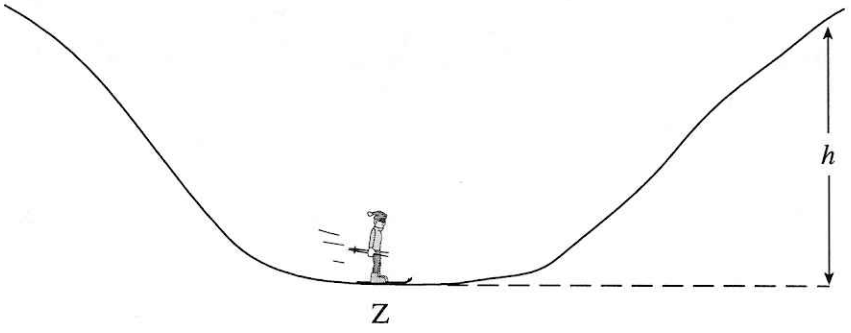


A. 1.5 N·s
B. 2.6 N·s
C. 3.0 N·s
D. 4.1 N·s

19. The 2.0 kg head of an axe strikes a tree horizontally at 40 m/s. The blade penetrates 0.040 m into the tree. What is the average force exerted by the blade on this tree?

A. 2.0×10^{1} N
B. 2.0×10^{3} N
C. 2.0×10^{4} N
D. 4.0×10^{4} N

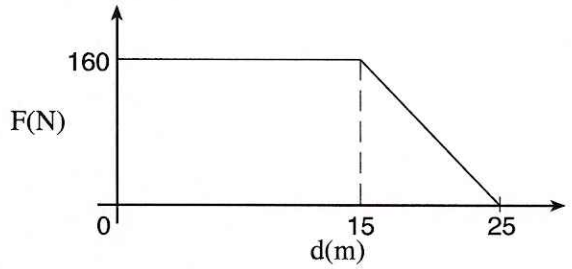
20. René, whose mass is 85 kg, skis down the hill, passing Z with a kinetic energy of 9 700 J.



If friction is ignored, to what maximum height, h, can René ski?

A. 12 m
B. 15 m
C. 1.1×10^{2} m
D. 6.6×10^{2} m

21. A cyclist travelling at 10 m/s applies her brakes and stops in 25 m. The graph shows the magnitude of the braking force versus the distance travelled.



What is the total mass of bike and cyclist?

A. 20 kg
B. 40 kg
C. 64 kg
D. 80 kg

22. Which equation is a form of Newton's second law?

A. $\vec{F}_{net} = \frac{\Delta\vec{p}}{\Delta t}$

B. $W = \Delta E$

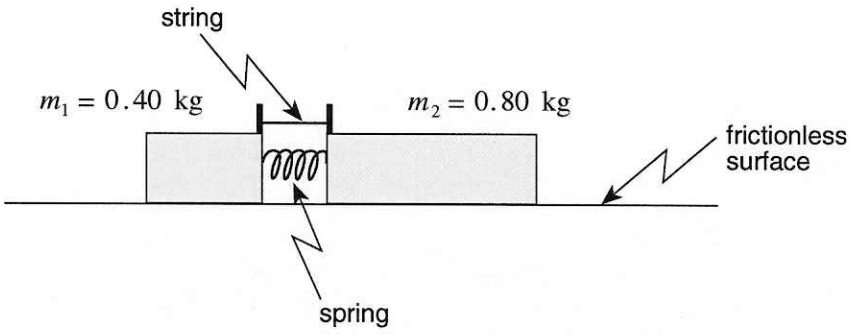
C. $E_k + E_p = E_k' + E_p'$

D. $\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$

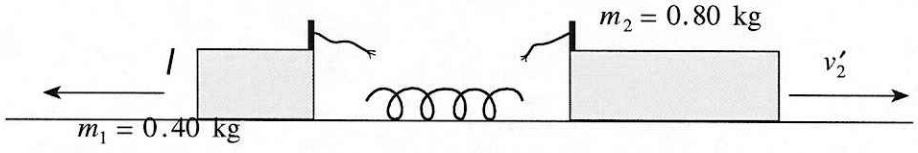
23. A 0.15 kg ball travelling at 25 m/s strikes a wall and bounces back in the opposite direction at 15 m/s. The ball is in contact with the wall for 0.030 seconds. What average force does the wall exert on the ball?

A. 25 N
B. 50 N
C. 1.0×10^2 N
D. 2.0×10^2 N

24. Two blocks are initially held together on a frictionless surface as shown in the diagram below.



When the string is cut, the blocks fly apart as shown.



$v_1' = 1.20$ m s

What work was done on the blocks by the spring?

A. 0 J
B. 0.29 J
C. 0.43 J
D. 0.58 J

25. A ball is thrown at 15 m/s towards various barriers. In which case does the ball experience the greatest impulse?

A. The ball hits a wall and rebounds at 2.0 m/s.
B. The ball hits a wall and rebounds at 7.0 m/s.
C. The ball hits a wall, sticks to it and stops moving.
D. The ball breaks a window and continues moving at 10 m/s in the same direction.

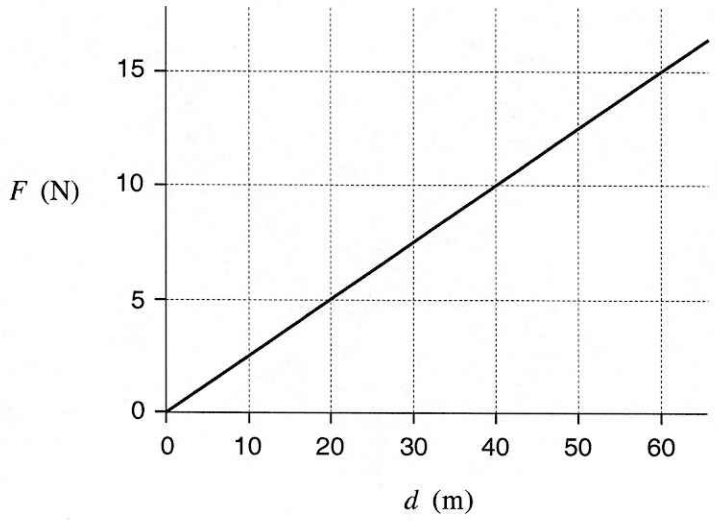
26. Which of the following is a definition of power?

A. Power is the rate of change of flux.
B. Power is the rate of change of energy.
C. Power is the rate of change of momentum.
D. Power is the rate of change of displacement.

27. A cyclist increases his kinetic energy from 1 100 J to 5 200 J in 12 s. His power output during this time is

A. 92 W
B. 260 W
C. 340 W
D. 430 W

28. The graph below shows how the force acting on an object varies with distance.



What is the work done in moving the object from 20 m to 60 m?

A. 50 J
B. 100 J
C. 400 J
D. 900 J

29. Which of the following are equivalent units for change in momentum?

A. $kg \cdot m/s^2$
B. $N \cdot s$
C. $kg \cdot s/m$
D. N/s

30. What is the minimum power output of a small electric motor that lifts a 0.050 kg mass through 2.0 m in 30 s?

A. 0.0017 W
B. 0.017 W
C. 0.033 W
D. 15 W

31. An object travelling due north experiences an impulse due east. The direction of the change in momentum of this object is

A. east.
B. west.
C. north.
D. northeast.

32. A 1.5 kg ball falling vertically strikes the floor with a speed of 12 m/s and rebounds upward with a speed of 8.0 m/s. What is the magnitude and direction of the impulse given to the ball?

	IMPULSE	DIRECTION
A.	6.0 N·s	upward
B.	6.0 N·s	downward
C.	30 N·s	upward
D.	30 N·s	downward

33. A net force of 20 N acts for 1.5 s on a 4.0 kg object initially at rest. What is the final kinetic energy of the object?

A. 30 J
B. 110 J
C. 230 J
D. 440 J