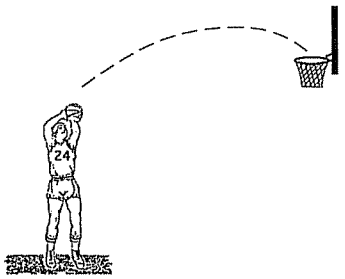
PHYSICS 12

NAME: _____

W, E, P & Momentum

1.

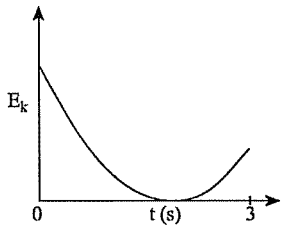
A basketball is thrown into the basket, as shown in the diagram below. The ball leaves the player hand at t= 0 s and reaches the basket at t = 3 s.



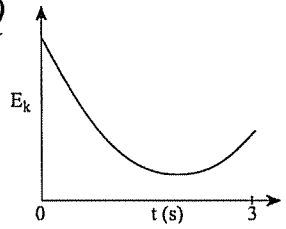
Which of the following graphs **best** represents the ball's kinetic energy E_k as a function of time?

$\frac{1}{2}mv^2$

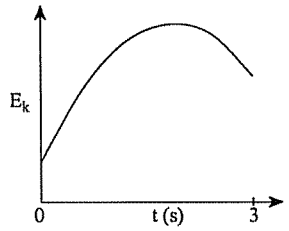
A.



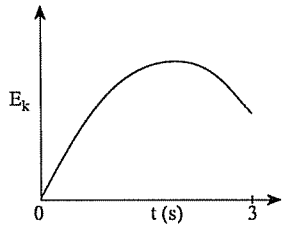
B.



C.



D.



2.

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

$\Delta E = E_k - E_0$

$= 0 - \frac{1}{2}(1800)(30)^2$

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

3.

Work is measured in which units?

A. J
B. N
C. J/s
D. N·s

4.

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?

$P = \frac{W}{t} = \frac{mgh}{t} = \frac{(75)(9.8)(4.5)}{5}$

$= 660\ W$

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

5.

A 3.5 kg projectile was launched vertically at 75 m/s. The projectile reached a maximum height of 180 m. How much energy was lost to heat while the projectile was rising?

$E_b = E_a$

$\frac{1}{2}mv^2 = mgh + E_h$

$\frac{1}{2}(3.5)(75)^2 = 3.5(9.8)(180) + E_h \quad E_h = 3700\ J$

A. 0 J
B. 3.7×10^{3} J
C. 6.2×10^{3} J
D. 9.8×10^{3} J

6.

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?

$E_b = E_a$

$E_K + E_P = E_K + E_P + E_H$

$600J + 5900 = 3200J + 0 + E_H \quad E_H = 3300\ J$

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

7.

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.

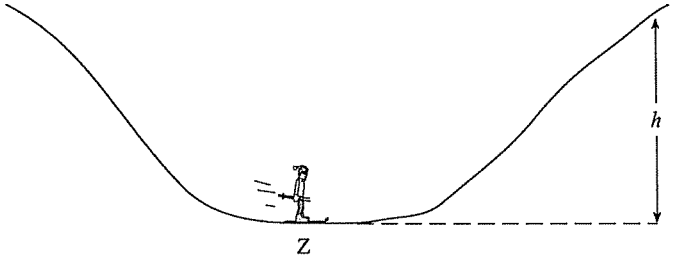
$P = \frac{W}{t} = \frac{\Delta E}{t} = \frac{2430J - 480J}{4.0}$

$= 490\ W$

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

8.

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



$E_B = E_a$

$E_K = E_P$

$9700 = mgh$

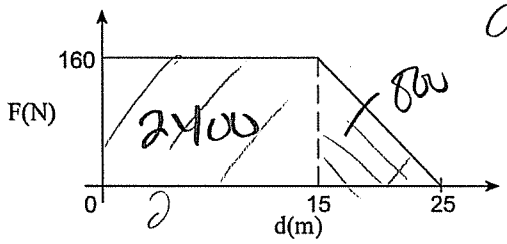
$h = 11.6\ m$

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

9.

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.



area = work

$= 3200\ J = \frac{1}{2}mv^2$

$= \frac{1}{2}m(10)^2$

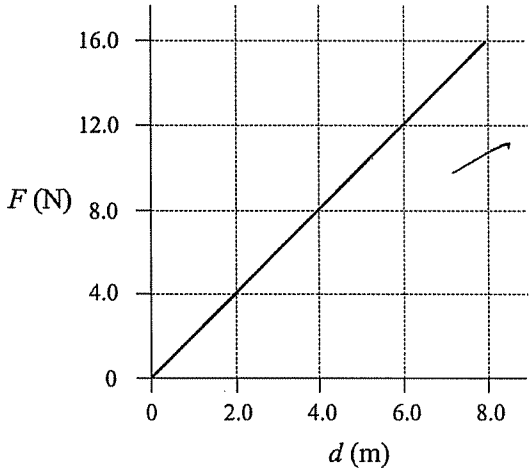
$m = 64\ kg$

What is the total mass of bike and cyclist?

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

10.

The graph below shows the relationship between the force applied and the distance moved for a 3.5 kg object on a frictionless horizontal surface.



area = work = ΔE

$= 64\ J$

If the object was initially at rest, what is its kinetic energy after travelling 8.0 m?

A. 2.0 J
B. 32 J
C. 64 J
D. 130 J

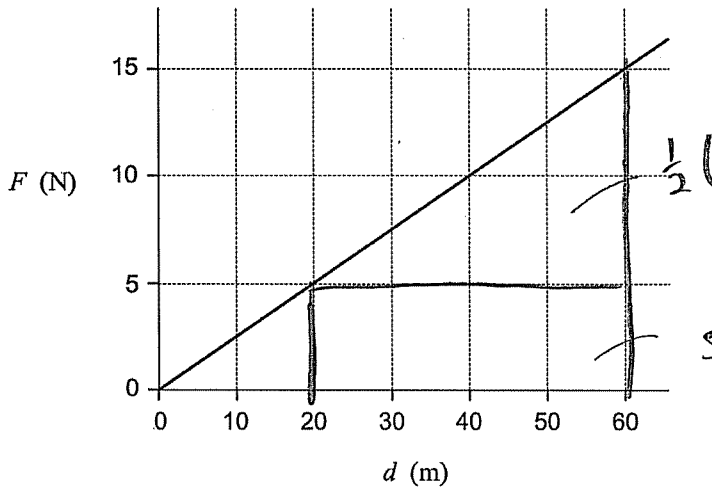
11.

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. $P = \frac{W}{t}$
C. Power is the rate of change of momentum.
D. Power is the rate of change of displacement.

12.

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



$\frac{1}{2}(40)(10) = 200$

$5 \times 40 = 200$

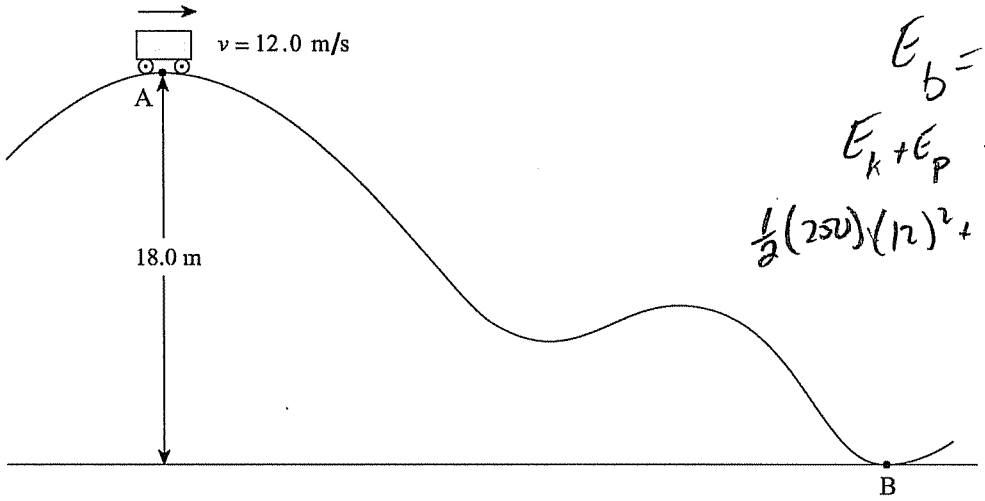
400 J

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

13.

A 250 kg roller coaster passes point A at 12.0 m/s.



$E_b = E_a$

$E_k + E_p = E_k + E_p + E_H$

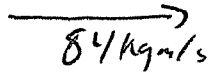
$\frac{1}{2}(250)(12)^2 + (250)(9.8)(18) = \frac{1}{2}(250)v^2 + 8500$

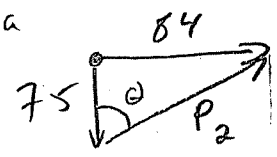
$v = 20.7 \text{ m/s}$

What is the speed of the roller coaster at point B at the bottom of the hill if 8 500 J of energy is transformed to heat during the journey? **(7 marks)**

14. A 7.0 kg object moving at 12 m/s to the east explodes into two unequal fragments. The larger 5.0 kg fragment moves at 15 m/s south. What is the velocity (speed and direction) of the smaller 2.0 kg fragment?

$P_b = P_a$





$P_2 = 112.6$ kgm/s

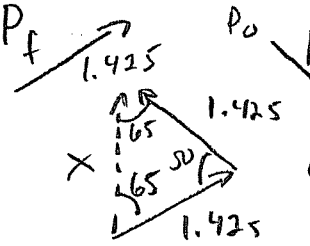
$V = 56.3$ m/s

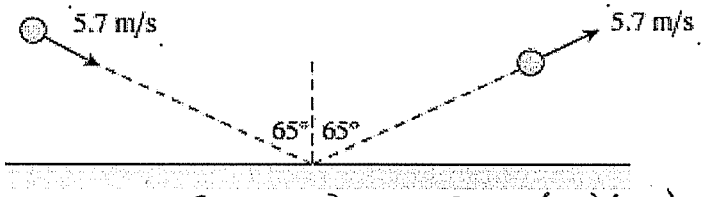
$\theta = \tan^{-1}\left(\frac{84}{75}\right) = 48°$ [E of N]

15. A 0.25 kg ball strikes the wall at 5.7 m/s and rebounds with the same speed and angle to the wall as shown. The ball's contact time was 0.22 s. What was the magnitude of the impulse on this ball?

A. 0.60 N s
B. 1.2 N s
C. 2.6 N s
D. 7.4 N s

$I = \Delta P = P_f - P_o$





cosine law $X^2 = 1.425^2 + 1.425^2 - 2(\ )(\ )\cos 50$

$X = 1.2$ kgm/s

16. 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?

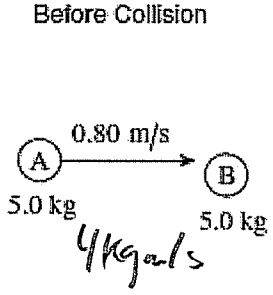
A. 25 N
B. 50 N
C. 1.0×10^2 N
D. 2.0×10^2 N

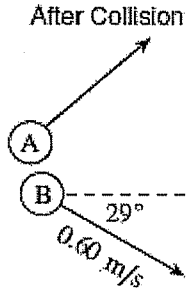
$I = \Delta P = F\Delta t = m\Delta v$

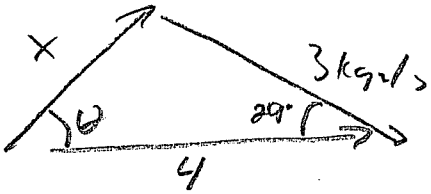
$F(.030) = (.15)(15 - -25)$

$F = 200$ N

17. A 5.0 kg puck A moving at 0.80 m/s to the right collides obliquely with an identical stationary puck B. Puck B then moves at 0.60 m/s as shown. What is the magnitude and direction of the momentum of puck A after the collision?



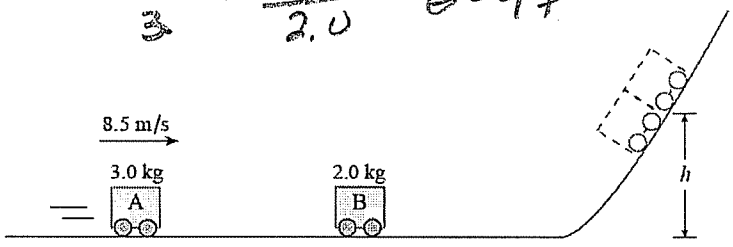




$X = 2.0$ kgm/s using cos. law

$\frac{\sin\theta}{3} = \frac{\sin 29}{2.0}$ $\theta = 47°$

18. A 3.0 kg car A travelling 8.5 m/s on a frictionless track collides and sticks on to a stationary 2.0 kg car B. The combined cars will reach what height *h*?



$P_b = P_a$

$m_1 v_1 = (m_1 + m_2)v$

$3(8.5) = (3+2)(V)$

$V = 5.1$ m/s

$E_b = E_a$

$E_K = E_p$

$\frac{1}{2}(5)(5.1)^2 = (5)(9.8)h$

$h = 1.3$ m

Answers:

1. b
2. d
3. a
4. b
5. b
6. b
7. c
8. a
9. c
10. c
11. b
12. c
13. v=20.7 m/s
14. 56.3 m/s @ 42° [N of E]
15. B
16. D
17. 2.0 m/s @ 47° [N of E]
18. 1.3 m