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DUE Wed, Sep 25, 2013 at 10:00

You now only get one chance at the multiple choice problems. Be sure to enter the letter beside the correct response.

1. [1pt]
A man pushes very hard for several seconds upon a heavy rock, but the rock does not budge. Has the man done any work on the rock?

A) Yes. The work done by the man on the rock is the same as the work done by the friction on the rock. Therefore, the rock does not move.
B) No. The work is force times distance, and the distance moved is zero
C) Yes. The work is the force exerted by the man on the rock times the distance the rock would have moved if it would have budged.

Correct, computer gets: B

2. [1pt]
You exert a force $F$ on a crate of mass $m$, moving it across the floor at a speed of $v$, a distance $d$. The quantity $Fd$ is

A) the linear momentum of the crate.
B) the work you do on the crate.
C) the kinetic energy of the crate.
D) the potential energy of the crate.

Correct, computer gets: B

3. [1pt]
For the crate above, the quantity $1/2mv^2$ is

A) the kinetic energy of the crate.
B) the linear momentum of the crate.
C) the potential energy of the crate.
D) the work you do on the crate.

Correct, computer gets: A

4. [1pt]
After boarding an airplane, you carry your 14.0-kg suitcase down the aisle to your seat, a distance of 15.0. What is the work done by you on the suitcase?

A) 2058.00 J  B) 147.00 J  C) 0.00 J  D) None

Force is not in direction of displacement.
5. [1pt]
After reaching your seat, you lift your 14.0-kg suitcase up by 1.80 m to put it into the overhead bin. What is now the work done by you on the suitcase?

A) 0.00 J  B) 246.96 J  C) 137.20 J  D) 17.64 J  E) 25.20 J

Correct, computer gets: B

6. [1pt]
A motorist runs out of gas on a level road 170 m from a gas station. The driver pushes the 1350-kg car to the gas station. If a 230-N force is required to keep the car moving, how much work does the driver do?

A) 2288200 J  B) 39100 J  C) 230 J  D) 2249100 J

Correct, computer gets: B

7. [1pt]
By what factor does the kinetic energy of a car change when its speed is increased by exactly a factor of 10?

Correct, computer gets: 100

8. [1pt]
Find the kinetic energy in joules of a 0.120 kg baseball moving with a speed of 45.0 m/s.

Correct, computer gets: 1.22e+02 J

9. [1pt]
A 2.3-kg block being pulled across a table by a horizontal force of 54 N also experiences a frictional force of 8.0 N. After the block has been pulled a distance of 3.3 m, what is the work done on the block by the pulling force?

Correct, computer gets: 178.2 J

10. [1pt]
What is the work done by the frictional force over this distance?

Correct, computer gets: -26.4 J

11. [1pt]
What is the speed of the block after it has covered this distance?

Correct, computer gets: 11.49 m/s

Hint: Use the work energy relation to find the kinetic energy.
An 83-kg man climbs up a 6.0-m high flight of stairs. What is the increase in gravitational potential energy?

Correct, computer gets: 4885.4 J

\[ U = mgh = (83 \text{ kg})(9.8 \text{ m/s}^2)(6.0 \text{ m}) = 4980.5 \text{ J} \]

13. [1pt]
Is it possible for a system to have energy if nothing is moving in the system?

A) No. If nothing is moving the velocity is zero and thus \(1/2mv^2=0\).
B) Yes, the system could have potential energy. Eventually this could get converted to kinetic energy.
C) No. If nothing is moving there are no forces and therefore also no energy.

Correct, computer gets: B

14. [1pt]
Students jump off diving board 3.6 m above the water surface. Ignoring air resistance, how fast are they going when they hit the water?

\[ U = mgh \rightarrow \text{ Energy conservation says all of this will become } KE \]

\[ \Rightarrow U = K \Rightarrow mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{\frac{2gh}{m}} = \sqrt{\frac{2(9.8 \text{ m/s}^2)(3.6 \text{ m})}{83 \text{ kg}}} \approx 8.4 \text{ m/s} \]

Correct, computer gets: D

15. [1pt]
A child on a swing has a speed of 8.4 m/s at the low point of the swing. How high will the swing be at the high point? (Challenge: you already know the answer. You don't need a calculator!)

This is just the inverse of the previous problem \( KE \rightarrow 0 U \)

A) 1.9 m  B) 7.2 m  C) 0.4 m
D) 3.6 m  E) 8.4 m

Correct, computer gets: D

16. [1pt]
A spring has a force constant of \( k = 105.0 \text{ N/m} \). How far must it be stretched for its potential energy to be 50.0 J?

Correct, computer gets: 9.76e-01 m

17. [1pt]
How far must it be stretched for its potential energy to be 140.0 J?

Correct, computer gets: 1.63e+00 m

18. [1pt]
In compressing the spring in a toy dart gun, 0.55 J of work is done. When the gun is fired, the spring gives its potential energy to a dart of mass 0.050 kg. What is the dart's kinetic energy as it leaves the gun?

Correct, computer gets: 0.55 J

19. [1pt]
What is the dart's speed?

A) 22 m/s  B) 4.7 m/s

A) 22 m/s  B) 4.7 m/s
20. [1pt]
How high must an 800 kg Ford Escort be lifted to gain an amount of potential energy equal to the kinetic energy it has when it is moving at 100.0 km/h?

\[ \text{Height} = \frac{100 \text{ km/h} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{3600 \text{ s}}}{\frac{1}{2} \text{ m/s}^2} = \frac{27.8 \text{ m}}{\frac{1}{2}} \rightarrow K = \frac{1}{2} m v^2 \]

Correct, computer gets: 39.3 m

21. [1pt]
A sprinter with a mass of 79 kg reaches a speed of 8.5 m/s in a race. What is the sprinter's linear momentum? Units for moment are entered as "kg m/s".

\[ \text{Linear Momentum} = m v = (79 \text{ kg})(8.5 \frac{\text{m}}{\text{s}}) = 670 \text{ kg m/s} \]

Correct, computer gets: 671.5 kg m/s

22. [1pt]
What is the kinetic energy of the sprinter?

\[ K = \frac{1}{2} m v^2 = \frac{1}{2} (79 \text{ kg})(8.5 \frac{\text{m}}{\text{s}})^2 = 2850 \text{ J} \]

Correct, computer gets: 2854 J

23. [1pt]
A pitcher throws a 0.50-kg ball of clay at a 8.0-kg block of wood. The clay sticks to the wood on impact, and their joint speed is 6.0 m/s. What was the original speed of the clay? Assume that the block was at rest.

Correct, computer gets: 102 m/s

24. [1pt]
How much kinetic energy is lost in the process?

\[ K_0 = \frac{1}{2} m_\text{clay} v_\text{clay}^2 = 2601 \text{ J} \]

\[ K_f = \frac{1}{2} (m_\text{clay} + m_\text{wood}) v_f^2 = 153 \text{ J} \]

\[ \Delta K = K_0 - K_f = 2448 \text{ J} \]

25. [1pt]
Two persons on ice skates stand face to face and then push each other away. Their masses are 64 kg and 73.0 kg. Which one has the higher speed afterwards?

A) The 64-kg person.
B) The 73-kg person.
C) Both the same since momentum is conserved.
D) Can't tell without knowing at least one of the speeds.

Correct, computer gets: A

26. [1pt]
If the speed of the 64-kg person is 2.0 m/s, what is the speed of the 73-kg person.

Correct, computer gets 1.8 m/s
27. [1 pt]
In a game of pool, the cue ball rolls across a table with velocity $v$.
It collides head-on with the eight ball which is initially at rest. Both balls have the same mass. After the collision

A) the cue ball will move backwards and the eight ball is still at rest.
B) the cue ball will be at rest and the eight ball will move with velocity $v$.
C) the eight ball will move 8 times as fast as the cue ball.
D) both balls will move with half the velocity.

Correct, computer gets: B

28. [1 pt]
A 0.45-kg hockey puck moving at 40.0 m/s hits the goal net and stops in 0.50 s. What is the magnitude of the impulse imparted to the object?

\[ \Delta P = m \Delta v = \frac{19.5 \text{ m/s}}{0.5 \text{ s}} = 39 \text{ N} \]

Correct, computer gets: 18.0 kg m/s

29. [1 pt]
What is the average net force exerted by the above collision?

Correct, computer gets: 36.0 N

30. [1 pt]
Problem 8-48:
When a 0.150-kg baseball is hit, its velocity changes from +23.0 m/s to -23.0 m/s. Determine the magnitude of the impulse delivered to the ball by the bat and use this to determine the average force exerted on the ball if the time of contact with the bat was 1.42 ms.

\[ \Delta P = P_f - P_i = mv_f - mv_i = (0.15 \text{ kg})(23.0 \text{ m/s}) - (0.15 \text{ kg})(-23.0 \text{ m/s}) = 6.9 \text{ N} \]

\[ F = \frac{\Delta P}{\Delta t} = \frac{6.9 \text{ N}}{1.42 \times 10^{-3} \text{ s}} = 4900 \text{ N} \]

31. [1 pt]
Which is more important in determining how much damage is done in a collision?

A) The initial speed of the object.
B) The total momentum change (impulse).
C) The momentum change per unit time (force).

Yes, Computer gets: C

32. [1 pt]
Which of the following three collisions would result in the most damage?

A) A car going 16 m/s colliding head on with an identical car at rest.
B) A head-on collision between two cars, both going 16 m/s.
C) A car going 16 m/s colliding head on with an immovable brick wall.

Yes, Computer gets: B

33. [1 pt]
Which case will do the least damage?

A) A car going 16 m/s colliding head on with an immovable brick wall.
B) A head-on collision between two cars, both going 16 m/s.
C) A car going 16 m/s colliding head on with an identical car at rest.

Two cars, twice the damage. However, the damage to a given car will be the same as hitting a brick wall since the force to stop the car is same.

This suggest the stopped car is allowed to move forward making time to stop for moving car greater $\Rightarrow$ less force.