Exam 3--PHYS 201--F15

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. It takes 100 m to stop a car initially moving at 25.0 m/s. The distance required to stop the same car moving at 50.0 m/s under the same conditions is
   a. 50.0 m.
   b. 25.0 m.
   c. 100 m.
   d. 200 m.
   e. 400 m.

2. Consider this figure. A cart starts at point A with a speed of 4 m/s. Which of the following statements best describes the cart’s energy at point (d). (Let the ground be h=0.)
   a. At point (d), PE=0 and KE=0.
   b. At point (d), PE>0 and KE=0.
   c. At point (d), PE=0 and KE>0.
   d. At point (d), PE>0 and KE>0.
   e. It depends on the mass of the cart.

3. By what factor does the kinetic energy of a car change if its velocity is doubled?
   a. 1
   b. 2
   c. 4
   d. 0.5
   e. 0.25

4. Entergy reads kilowatt-hours from our electric meters. What is this a measure of?
   a. force
   b. power
   c. energy
   d. flow of electricity

5. Which of these statements is/are true?
   I. Conservative forces require contact between 2 objects.
   II. Field forces conserve energy.
   III. Friction is a conservative force.
   IV. Conservative forces are path-dependent.
   a. II & IV
   b. I, III, and IV
   c. II only
   d. all are true

6. Two paths lead to the top of a big hill. One is steep and direct while the other is twice as long but less steep. How much more potential energy would you gain if you took the longer path?
   a. the same
   b. twice as much
   c. you gain no potential energy
   d. four times as much
   e. one-half as much

7. A spring has a spring constant of 1200 N/m. You apply a force of 600. N to compress the spring. By how much do you compress the spring?
   a. 720,000 m
   b. 3.4 m
   c. 1.0 m
   d. 0.50 m
   e. 2.0 m

8. An open cart rolls along a frictionless track while it is raining. As it rolls, what happens to the speed of the cart as the rain collects in it? (assume that the rain falls vertically into the box)
   a. speeds up
   b. maintains constant speed
   c. slows down
   d. stops immediately
9. Consider this perfectly inelastic collision. What is the magnitude of the final velocity of the two particles?

![Diagram of collision]

- 3.3 m/s
- 0.5 m/s
- 0.67 m/s
- 12 m/s
- 1.5 m/s

10. A uranium nucleus is at rest and undergoes fission and splits into two fragments, one heavy and one light. Which of these statements is true?

![Diagram of fission]

- The heavier fragment has a higher velocity than the light one
- The lighter and heavier fragments have the same momentum (but in opposite directions)
- The lighter and heavier fragments have the same velocity (but in opposite directions)
- The lighter fragment has more momentum than the heavy one

11. A force of 100 N acts on a 100 kg boulder for 2 seconds; the same force acts on a 1 kg stone for 2 seconds. Which experiences the larger change in momentum?

- The boulder
- The stone
- Both the same

12. Which of these bodies has the largest momentum? (“M” represents mass; “V” represents velocity.)

I. Mass 8M and speed V
II. Mass M and speed 8V
III. Mass 3M and speed 3V
IV. Mass 2M and speed 3V

- I & II
- III alone
- IV alone
- III & IV
- II alone

13. If the momentum of an object is tripled, its kinetic energy will change by what factor? (Assume the mass of the object is unchanged.)

- Nine
- One-third
- Three
- Zero

14. Which of these bodies has the largest energy? (“M” represents mass; “V” represents velocity.)

I. Mass 8M and speed V
II. Mass M and speed 8V
III. Mass 3M and speed 3V
IV. Mass 2M and speed 3V

- I & II
- III alone
- IV alone
- III & IV
- II alone

15. A rubber ball and a lump of putty having the same mass are thrown with the same speed toward a wall. The ball bounces back with nearly the same speed as it hit. The putty sticks to the wall. Which of the two experiences the greater momentum change?

- The putty.
- In both cases there is no change in momentum.
- They experience the same change in momentum.
- The ball.
- More information is needed to work out the answer.
16. (15 pts) A cart with mass 35 kg begins on this track at point (a) with zero speed. The track is frictionless.

(4 pts) a) What is the speed of the cart at point (b)?

(4 pts) b) If the speed of the cart is 10.0 m/s, what is the height h?

(7 pts) c) On the flat part of the track, the cart encounters a resistive force, given by the function above. How far does the cart travel before stopping?
17. (15 pts) A 3.0 kg object sits on a frictionless, flat surface. A force acts on the object; the force is given by the following function:
\[
\vec{F} = 4.0\hat{i} + 6.0\hat{k}
\]
The force acts over a distance
\[
\vec{d} = 5.0\hat{i} - 2.0\hat{k}
\]
(5 pts) a) What work does the force do on the object?
(5 pts) b) What is the final velocity of the object?
(5 pts) c) The object travels until it encounters a spring (head-on) with a spring constant of 1200 N/m. The object compresses the spring and comes to rest. How much distance does the spring compress?

18. (10 pts) Consider the following inelastic collision. What is the final velocity (in vector notation) of \( m_2 \)?
19. (5 pts) What is the difference between an inelastic and elastic collision? Give an example of each.
   a) Difference:
   b) Example of inelastic collision:
   c) Example of elastic collision:

20. (5 pts) A fire fighter sprays water horizontally at 10.0 m/s directly at the wall of a house on fire. If 25 kg of water are delivered in 2.5 seconds, what is the magnitude of the average force on the wall due to water, assuming that after the impact the water falls straight down the wall?
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Answer Section

MULTIPLE CHOICE

1. ANS: E  PTS: 1  REF: F15
2. ANS: D  PTS: 1  REF: F15
3. ANS: C  PTS: 1  REF: F15
4. ANS: C  PTS: 1
5. ANS: C  PTS: 1  REF: F15
6. ANS: A  PTS: 1
7. ANS: D  PTS: 0  REF: F15
8. ANS: C  PTS: 1  REF: F15
9. ANS: C  PTS: 1  REF: F15
10. ANS: B  PTS: 1  REF: F15
11. ANS: C  PTS: 1  REF: F15
12. ANS: B  PTS: 1  REF: F15
13. ANS: A  PTS: 1  REF: F15
14. ANS: E  PTS: 1  REF: F15
15. ANS: D  PTS: 0  DIF: 2

PROBLEM

16. ANS:

PTS: 1
17. ANS:

PTS: 1
18. ANS:

PTS: 1
19. ANS:

PTS: 1
20. ANS: 100 N

PTS: 1