1. A particle accelerates for 2 seconds. If its final velocity is 5 m/s, and its initial velocity was 15 m/s, what was its acceleration?

(A) -2.5 m/s2

(B) -5 m/s2

(C) -10 m/s2

(D) -15 m/s2

(E) 2.5 m/s2

2. A particle moving at 5 m/s reverses its direction in 1 s to move at 5 m/s in the opposite direction. If its acceleration is constant, what is its speed at 0.5 s?

(A) 0 m/s

(B) 1.25 m/s

(C) 2.5 m/s

(D) 5 m/s

(E) 10 m/s

3. A block experiencing a net force of 12 N is accelerated at 36 m/s2. What is the mass of the block?

(A) 0.33 kg

(B) 1 kg

(C) 3 kg

(D) 36 kg

(E) 50 kg

4. A 2 kg block rests on a flat board. One end of the board is slowly lifted until the block begins to slide. If the block begins to slide when the board is at an angle of 30° with the horizontal, what is the coefficient of static friction between the block and the board?

(A) 0.1

(B) 0.6

(C) 1

(D) 2

(E) 3

5. A 2 kg mass is placed on top of a spring (k = 400 N/m) and then pushed downwards with a force of 30 N. How many centimeters is the spring compressed from its relaxed position?

(A) 0.5 cm

(B) 5 cm

(C) 7.5 cm

(D) 12.5 cm

(E) 15 cm

6. A 6.12 g bullet traveling 284 m/s penetrates 6.08 cm into a wall before stopping. What is the average force of the wall on the bullet?

(A) -1212 N

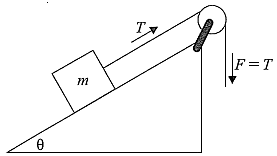
(B) 2100 N

(C) -4432 N

(D) 6271 N

(E) -4059 N

7. The plane below is frictionless and inclined at a 30° angle. The mass m is 6 kg. If the mass is lowered at a constant velocity, what is the tension T in the rope?



(A) 0 N

(B) 30 N

(C) 60 N

(D) 90 N

(E) 120 N

8. A solid spherical conductor of radius 15 cm has a charge *Q* = 6.5 nC on it. A second, initially uncharged, spherical conductor of radius 10 cm is moved toward the first until they touch and is then moved far away from it. How much charge is there on the second sphere after the two spheres have been separated?

(A) 3.6 nC

(B) 2.2 nC

(C) 3.2 nC

(D) 3.9 nC

(E) 2.6 nC

9. A 2.47 kg block slides down a ramp from a height of 4.57 m. The block has a speed of 3.56 m/s when it reaches the bottom. There is friction. What is the work done by gravity?

(A) 421 J

(B) 611.3 J

(C) 71.5 J

(D) 80.9 J

(E) 110.6 J

10. A 2 kg ball and a 4 kg ball are thrown upwards each with a speed of 20 m/s. At what height will the 2 kg ball be, when the kinetic energy of the balls are equal?

(A) 5 m

(B) 10 m

(C) 15 m

(D) 20 m

(E) 22 m

11. A 10,000 kg locomotive speeds toward Asem at 10 m/s, and will hit her in 10 s if Superman doesn’t try to stop it. If Superman applies a constant force, what average power does he need in order to stop the train?

(A) 2.5104 W

(B) 5.0l04 W

(C) 2.5105 W

(D) 5.0l05 W

(E) 5.0l06 W

12. A mass of 10 kg is moved vertically upwards through a distance of 11 m. If the gravitational acceleration is 9.8 m/s2, then the work done against gravity is

(A) 107.8 J

(B) 30 J

(C) 17.8 J

(D) 50 J

(E) 1078 J

13. boy on a sled slides over a frozen lake at 10 m/s. The boy has a mass of 40 kg, the sled has a mass of 10 kg. If the boy rolls off the sled, the sled will most likely continue to move at:

(A) 2 m/s

(B) 8 m/s

(C) 10 m/s

(D) 50 m/s

(E) 45 m/s

14. An Dielectric breakdown occurs in the air at an electric field strength of *E*max = 3×106 V/m. If the maximum charge that can be placed on a spherical conductor is 2×10–3 C before breakdown, calculate the diameter of the sphere.

(A) 6 m

(B) 5.8 m

(C) 1.2 m

(D) 4.9 m

(E) 3 m

15. A positive point charge of 10–4 C is located 3 m from another positive point charge of 10–5 C. Their mutual electric potential energy is

(A) 2 J

(B) 1 J

(C) 0

(D) -1 J

(E) -2 J

16. Calculate the change in electrostatic potential energy of a charge, *Q* = 1 µC, when it is moved from a distance *x* = 4 m to 2 m from an infinite plane of uniform surface charge density *σ* = 10 µC/m2.

(A) 0.135 J

(B) 0.565 J

(C) 1.69 J

(D) 2.82 J

(E) 1.13 J

17. A ball has a volume of 1 L and a mass of 0.75 kg. If the ball is floating in water, what portion of the ball will float above the surface?

(A) 0

(B) 0.25

(C) 0.5

(D) 0.75

(E) 1

18. A person sits on a stationary sled (total mass of person + sled = 100 kg) on a pond of smooth ice and holds a ball. If the 2 kg ball is thrown at a speed of 10 m/s, find the speed with which the person and sled move afterward.

(A) 0 m/s

(B) 0.1 m/s

(C) 0.3 m/s

(D) 0.4 m/s

(E) 0.2 m/s

19. If a capacitor of capacitance 2 µF is given a charge of 1 mC, the potential difference across the capacitor is

(A) 0.8 kV

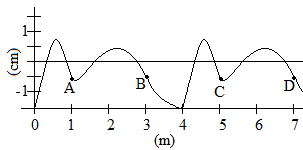
(B) 1 kV

(C) 4 kV

(D) 0.5 kV

(E) 0.3 kV

20. If the wave above is moving at 2 m/s to the right, what is its frequency?



(A) 0.25 s-1

(B) 0.5 s-1

(C) 2 s-1

(D) 8 s-1

(E) 10 s-1

21. The speed of sound is approximately 340 m/s. A police siren sounds at 1000 Hz. If a stationary observer hears the siren at 1100 Hz, what is the approximate speed of the police car?

(A) 34 m/s toward the observer

(B) 34 m/s away from the observer

(C) 68 m/s toward the observer

(D) 68 m/s away from the observer

(E) 90 m/s away from the observer

22. You want to store 1010 excess electrons on the negative plate of a capacitor at 9 V. How large a capacitance must you use?

(A) 0.014 µF

(B) 0.18 µF

(C) 0.18 nF

(D) 14 pF

(E) 5.6 pF

23. What is the effective capacitance of the three capacitor unit below?



(A) 

(B) 1

(C) 3

(D) 9

(E) 10

24. A coaxial cable consists of a wire of radius 0.3 mm and an outer conducting shell of radius 1 mm. Its capacitance per unit length is approximately

(A) 17 nF/m

(B) 0.11 nF/m

(C) 46 pF/m

(D) 23 pF/m

(E) 92 pF/m

25. Two charges each of 2 µC are placed 0.5 m apart in air. The force between them is:

(A) 0.144 N

(B) 1.44 N

(C) 14.4 N

(D) 0.0144 N

(E) 144 N

26. An electric current passes through a long straight wire. The magnetic field at a distance 5 cm from the wire is *B*, the magnetic field at a distance of 20 cm from the wire will be:

(A) 8*B*

(B) 0.125*B*

(C) 0.25*B*

(D) 4*B*

(E) 2*B*

27. A plano-convex lens is made of glass of refractive index 1.6. The radius of curvature of the curved surface is 60 cm. The focal length of the lens is:

(A) 0.5 m

(B) 1 m

(C) 3 m

(D) 5 m

(E) 7 m

28. A black body of surface area 10 cm2 is at 27°C. The rate of energy rediated by it is *E*. If its temperature is raised to 627°C, the rate of energy radiated will increase by:

(A) 40*E*

(B) 40*E*

(C) 80*E*

(D) 90*E*

(E) 100*E*

29. Binding energies per nucleon of deuteron (1H2) and helium atom (2He4) are 1.1 MeV and 7 MeV respectively. If two deuteron atoms react to form a single helium atom, then the energy released is:

(A) 12.3 MeV

(B) 23.6 MeV

(C) 39.9 MeV

(D) 52.4 MeV

(E) 72.3 MeV

30. A ring of radius 20 cm is hinged from a point on its periphery. The time period of its oscillations will be: (g = 9.8 m/s)

(A) 4 s

(B)

(C)

(D)

(E) 2