1. A particle starts from rest and accelerates at 10 m/s2. How long does it take for the particle to travel 45 m?

(A) 2 s

(B) 3 s

(C) 4.5 s

(D) 45 s

(E) 60 s

2. A particle moving at 10 m/s reverses its direction to move at 10 m/s in the opposite direction. If its acceleration is -10 m/s2, what is the time required?

(A) 1 s

(B) 2 s

(C) 3 s

(D) 4 s

(E) 5 s

3. An 8 kg block experiences a net force of 160 N. Its velocity increases by 40 m/s. For how long did the force act on the block?

(A) 2 s

(B) 5 s

(C) 10 s

(D) 40 s

(E) 50 s

4. A 2 kg object is placed on a plane inclined at an angle of 30°. If the coefficient of static friction is 1, and the coefficient of kinetic friction is 0.1, what is the net force on the block?

(A) 0 N

(B) 2.7 N

(C) 17.3 N

(D) 37.3 N

(E) 50 N

5. A man compresses a 30 cm spring against a wall. If he applies a 100 N force and the wall is rigid, by how much does he shorten the spring? (k = 1000 N/m)

(A) 5 cm

(B) 10 cm

(C) 20 cm

(D) 30 cm

(E) 50 cm

6. A block has a coefficient of friction of 0.225 with a plane that is inclined 21.1º above the horizontal. What is its acceleration along the plane?

(A) 1.47 m/s2

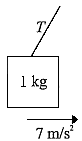
(B) 2.33 m/s2

(C) 1.33 m/s2

(D) 2.00 m/s2

(E) 1.88 m/s2

7. The mass below hangs inside a boxcar of a train. If the train accelerates at 7 m/s2, what is the approximate tension T in the rope?



(A) 7 N

(B) 10 N

(C) 12 N

(D) 17 N

(E) 20 N

8. A brick dropped from a roof hits the ground 3.13 seconds later. How high was the roof?

(A) 18 m

(B) 28 m

(C) 38 m

(D) 45 m

(E) 48 m

9. A spring compressed by 7.09 cm is used to propel a 134 g pellet vertically upward to a maximum height of 8.16 m. What is the spring constant?

(A) 1400 N/m

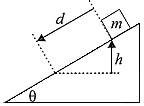
(B) 4000 N/m

(C) 400 N/m

(D) 1233 N/m

(E) 4257 N/m

10. If is 30°, and m is 2.5 kg, how much work is done on the block if it slides 20 cm?



(A) 2.5 J

(B) 5 J

(C) 25 J

(D) 50 J

(E) 100 J

11. A forklift moves a 500 kg box from one 4 m shelf to a second 4 m shelf in 100 s. What is the minimum power required by the forklift?

(A) 0

(B) 2102 W

(C) 2104 W

(D) 2106 W

(E) 2108 W

12. A body loses 6174 J of potential energy in falling through 70 m. If the gravitational acceleration is 9.8 m/s2, then the body has a mass of

(A) 5 kg

(B) 3 kg

(C) 7 kg

(D) 8 kg

(E) 9 kg

13. A 1 kg lump of clay moving through space at 2 m/s collides with a second 1 kg lump of clay at rest. If the lumps stick together what portion of the original kinetic energy is lost to internal energy?

(A) 25%

(B) 50%

(C) 75%

(D) 100%

(E) 0%

14. A winding path leads to the top of a 100 m tall mountain. The path is 1.2 km long and at a constant incline. How much work is done on a 24 kg backpack of a hiker that walks up the mountain along this path?

(A) 2,000 J

(B) 12,000 J

(C) 24,000 J

(D) 48,000 J

(E) 72,000 J

15. If 30 g of substance *X* remain from an original sample of 240 g after 300 days, what is the half-life of substance *X*?

(A) 50 days

(B) 100 days

(C) 150 days

(D) 200 days

(E) 366 days

16. A rigid container holds air (density 1.3 kg/m3) at 1 atm. If the pressure is increased to 2 atm by adding more air, what is the density of the air?

(A) 0.65 kg/m3

(B) 1.3 kg/m3

(C) 2.6 kg/m3

(D) 3.9 kg/m3

(E) 4.8 kg/m3

17. A particle with a charge of 5.5×10−8 C is 3.5 cm from a particle with a charge of −2.3×10−8 C. The potential energy of this two-particle system, relative to the potential energy at inﬁnite separation is:

(A) 3.2×10−4 J

(B) −3.2×10−4 J

(C) 9.3×10−3 J

(D) −9.3×10−3 J

(E) −33×10−3 J

18. A crate with mass 50 kg is pushed across a horizontal floor at a constant speed of 1 m/s for 4 seconds by a horizontal force *F* of magnitude 100 N. How much work is done by *F*?

(A) 0 J

(B) 100 J

(C) 200 J

(D) 400 J

(E) 800 J

19. A block of metal weighs 500 N in air but weighs only 300 N when it is totally submerged in water. What is the specific gravity of this metal?

(A) 1

(B) 0.5

(C) 5

(D) 0.25

(E) 2.5

20. If the average power of a sound wave is increased by a factor of 10, by how much does the intensity level increase?

(A) 1 dB

(B) 2 dB

(C) 10 dB

(D) 100 dB

(E) 300 dB

21. Under the action of a certain constant net force, an object of mass 2 kg travels in a straight line with a constant acceleration of 4 m/s2. If this same net force is applied to an object with four times the mass, the acceleration will be:

(A) 2.5 m/s2

(B) 1.5 m/s2

(C) 2 m/s2

(D) 0.5 m/s2

(E) 1 m/s2

22. Positively charged particle A starts at rest and is pulled from a great distance directly toward negatively charged particle B by the electric field created by particle B. If particle A has a velocity *v* when it is a distance 4r from particle B, what will be the velocity of particle A when it is a distance *r* from particle B?

(A) 0.5*v*

(B) *v*

(C) 2*v*

(D) 4*v*

(E) 5*v*

23. A 1 µF capacitor and a 2 µF capacitor are connected in series across a 1200 V source. The charge on each capacitor is

(A) 0.8 mC

(B) 0.4 mC

(C) 1.2 mC

(D) 1.8 mC

(E) 3.6 mC

24. What is the electric field at a point halfway between the two charges? (Two identical positive charges *Q* are separated by a distance *a*, as shown below).



(A)

(B)

(C) 0

(D)

(E)

25. The space between the inner wire of radius *a* = 1 mm of a co-axial cable and the conducting shield of radius *b* = 8 mm is made of nylon (*k* = 4.2). A potential difference of 20 V is maintained between the wire and the shield. The energy stored per meter of the cable is

(A) 1.12 nJ/m

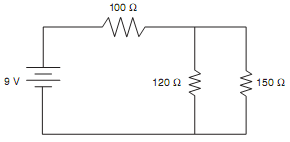
(B) 28.5 nJ/m

(C) 22.5 nJ/m

(D) 5.36 nJ/m

(E) 2.68 nJ/m

26. A 100 Ω, 120 Ω, and 150 Ω resistor are connected to a 9 V battery in the circuit shown below. Which of the three resistors dissipates the most power?



(A) The 100 Ω resistor

(B) The 120 Ω resistor

(C) The 150 Ω resistor

(D) Both the 120 Ω and 150 Ω

(E) All dissipate the same power

27. A 1 F capacitor is connected to a 12 V power supply until it is fully charged. The capacitor is then disconnected from the power supply, and used to power a toy car. The average drag force on this car is 2 N. About how far will the car go?

(A) 36 m

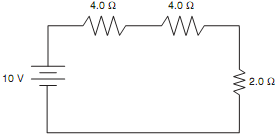
(B) 72 m

(C) 144 m

(D) 24 m

(E) 12 m

28. Three resistors are connected to a 10 V battery as shown in the diagram below. What is the current through the 2.0 Ω resistor?



(A) 0.25 A

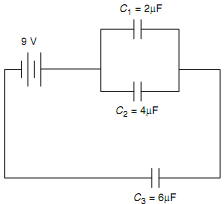
(B) 0.5 A

(C) 1 A

(D) 2 A

(E) 4 A

29. Three capacitors are connected as shown in the diagram below. *C*1 = 2 µF; *C*2 = 4 µF; *C*3 = 6 µF. If the battery provides a potential of 9 V, how much charge is stored by this system of capacitors?



(A) 3 µC

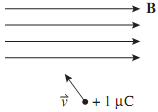
(B) 30 µC

(C) 2.7 µC

(D) 27 µC

(E) 10 µC

30. A point charge of +1 µC moves with velocity *v* into a uniform magnetic field *B* directed to the right, as shown below. What is the direction of the magnetic force on the charge?



(A) To the right and up the page

(B) Directly out of the page

(C) Directly into the page

(D) To the right and into the page

(E) To the right and out of the page