1. A constantly accelerating particle starts from rest and travels 50 m. If it reaches a velocity of 100 m/s, how long did the 50 m trip take?

(A) 0.5 s

(B) 1 s

(C) 2 s

(D) 3 s

(E) 4 s

2. An object is dropped from a height *h* and strikes the ground in time t.In order to double the flight time of the object, it must be dropped from a height of:

(A) *h*

(B) 1.4*h*

(C) 2*h*

(D) 4*h*

(E) 8*h*

3. A 3 kg box is pushed along the ground at a constant velocity for 10 s. What is the net force acting on the box?

(A) 0

(B) 0.3 N

(C) 3.3 N

(D) 30 N

(E) 50 N

4. A car moving at 20 m/s brakes and slides to a stop. If the coefficient of kinetic friction between the pavement and the tires of the car is 0.1, how far does the car slide?

(A) 50 m

(B) 100 m

(C) 200 m

(D) 400 m

(E) 500 m

5. A 2 kg mass swinging at the end of a 0.5 m string is traveling 3 m/s. What is the **centripetal acceleration** of the mass?

(A) 5 m/s2

(B) 12 m/s2

(C) 14 m/s2

(D) 13 m/s2

(E) 18 m/s2

6. Two forces, 4.82 N and 6.93 N, 37.9º apart are acting on a 5 kg object. What is the magnitude of the object's acceleration?

(A) 1.50 m/s2

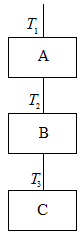
(B) 2.23 m/s2

(C) 1.39 m/s2

(D) 2.00 m/s2

(E) 1.18 m/s2

7. Boxes *A*, *B*, and *C* each have a mass of 10 kg. If the rope can withstand a maximum tension of 600 N, how quickly can the boxes be pulled upwards a distance of 20 m starting from rest?



(A) 1 s

(B) 2 s

(C) 3 s

(D) 4 s

(E) 5 s

8. A stone is thrown straight up at 5.77 m/s. What is the stone's acceleration at the top of its rise?

(A) 10 m/s2

(B) 4.9 m/s2

(C) -4.9 m/s2

(D) -7.63 m/s2

(E) -9.8 m/s2

9. A pendulum with a mass of 0.312 kg and a length of 1.025 m is displaced through an angle of 28.4º then released. Eventually the maximum angle of swing is only 10º. How much energy has been lost to friction?

(A) 1 J

(B) 4 J

(C) 1.33 J

(D) 2 J

(E) 0.33 J

10. A 4 kg block moving 10 m/s slides to a stop over 5 m. What was the force of friction on the block?

(A) 10 N

(B) 20 N

(C) 30 N

(D) 40 N

(E) 50 N

11. A car travels 90 minutes on the highway. For the first 30 minutes it travels 74.8 km/h. It maintains 95.5 km/h for the remainder of the trip. What was the average speed of the vehicle in?

(A) 88.6 km/h

(B) 90.0 km/h

(C) 110 km/h

(D) 75.7 km/h

(E) 100 km/h

12. A mass of 100 kg is moved vertically upwards through a distance of 6 m. If the gravitational acceleration is 9.8 m/s2, then the work done against gravity is

(A) 2150 J

(B) 4230 J

(C) 5880 J

(D) 6450 J

(E) 1568 J

13. A 2 kg ball moving at 4 m/s collides elastically with a 6 kg ball that is stationary. If the 2 kg ball bounces off with a speed of 2 m/s, what is the speed of the 6 kg ball?

(A) 0.33 m/s

(B) 0.67 m/s

(C) 2 m/s

(D) 3 m/s

(E) 4 m/s

14. A frictionless ramp is 4 m high and 36 m long. How much force is required to push a 180 kg box up the ramp?

(A) 200 N

(B) 300 N

(C) 600 N

(D) 900 N

(E) 1300 N

15. Uranium-238 undergoes alpha decay to form:

(A) Thorium-234

(B) Thorium-238

(C) Protactinium-234

(D) Uranium-234

(E) Uranium-253

16. Mercury has a specific gravity of 13.6. 13.6 grams of mercury occupies a volume of:

(A) 1 cm3

(B) 13.6 cm3

(C) 136 cm3

(D) 185 cm3

(E) 200 cm3

17. A motor running from a 220 V line is lifting a mass of 35 kg against Earth's gravity at a constant speed of 6 m/s. If we assume 100% efficiency, the current required is

(A) 0.27 A

(B) 5.4 A

(C) 7.7 A

(D) 9.4 A

(E) 4.7 A

18. A object is raised to a height of 16 m and released from rest. At the instant that the object is 12 m above the ground, what fraction of its total mechanical energy is in the form of kinetic energy?

(A) 0.25

(B) 1

(C) 0.5

(D) 0.75

(E) 0.67

19. A cylindrical container holds water and Fluid *Q* whose specific gravity is 0.5. The two fluids are immiscible. The gauge pressure at the foot of the column is 75% of what it would be if all the fluid in the column were water. Fluid *Q* must therefore account for what percentage of the total fluid in the column?

(A) 20%

(B) 30%

(C) 35%

(D) 45%

(E) 50%

20. A sound source increases its average power output from 20 W/m2 to 200 W/m2. What is the corresponding increase in decibels to any observer?

(A) 1 decibel

(B) 10 decibels

(C) 100 decibels

(D) 180 decibels

(E) 345 decibels

21. A 40 kg crate is being pulled along a frictionless surface by a force of magnitude 140 N that makes an angle of 30° with the horizontal. What is the acceleration of the crate?

(A) 3.5 m/s2

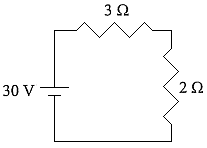
(B) 2.5 m/s2

(C) 3 m/s2

(D) 1.5 m/s2

(E) 1 m/s2

22. What is the voltage across the 3 ohm resistor and the current through the 3 ohm resistor in the circuit shown below?



(A) 10 V, 3 A

(B) 12 V, 6 A

(C) 18 V, 6 A

(D) 18 V, 10 A

(E) 14 V, 12 A

23. What is the voltage drop across an electric motor with a resistance of 25 ohms that draws 10 amps of current?

(A) 0.4 V

(B) 2.5 V

(C) 250 V

(D) 2500 V

(E) 400 V

24. Each of three identical electric heaters is rated at 1000 W when operated across 100 V lines. When the three are connected in series across a 120 V line, at what rate is electric energy converted to heat energy? (Neglect variation of resistance with temperature.)

(A) 0.75 kW

(B) 1.5 kW

(C) 0.48 kW

(D) 3.2 kW

(E) 3.6 kW

25. The current in the wire is flowing



(A) Into the page

(B) Out of the page

(C) Clockwise

(D) Counterclockwise

(E) None of the above

26. If the length of wire cutting the magnetic field is 0.5 m, its velocity is 1 m/s and the magnetic field has a strength of 0.75 T, the emf in the wire is most nearly



(A) 0.2 V

(B) 0.4 V

(C) 0.6 V

(D) 0.8 V

(E) 1 V

27. A current supplied to a coil of wire with 100 turns develops a flux of 10–4 Wb and grows to 1 A in 2 sec. The coil’s induced emf is

(A) –5×10–4 V

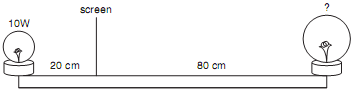
(B) –5×10–3 V

(C) –5×10–2 V

(D) –5×10–1 V

(E) –5×104 V

28. A lamp with a 10 W bulb is placed at one end of a meter stick. At the other end is placed a second lamp with a bulb of unknown wattage. Assuming that the wattage rating for the power consumed is proportional to the bulb’s luminous intensity, if a screen placed 20 cm from the 10 W lamp is equally illuminated by both lamps, the unknown lamp is marked



(A) 60 W

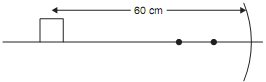
(B) 80 W

(C) 100 W

(D) 160 W

(E) 200 W

29. A box placed 60 cm away from a concave spherical mirror forms a real image 15 cm from the mirror if the mirror’s focal length is



(A) 6 cm

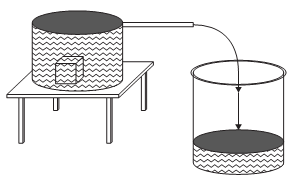
(B) 10 cm

(C) 12 cm

(D) 14 cm

(E) 15 cm

30. An object of mass 2.6 kg is completely immersed in a tub of water (*ρ*water = 1000 kg/m3). If it displaces 1.3 kg of water, the specific gravity of the object is closest to



(A) 0.5

(B) 1.5

(C) 2

(D) 1

(E) 0.75