1. A particle accelerates at 10 m/s2 for 2 seconds. If its final velocity is 5 m/s, what was its initial velocity?

(A) -25 m/s

(B) -15 m/s

(C) 25 m/s

(D) 50 m/s

(E) 75 m/s

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 distance does it travel?

(A) 1.25 m

(B) 2.5 m

(C) 5 m

(D) 10 m

(E) 20 m

3. A 25 kg block accelerates at 5 m/s2, what is the net force acting on the block?

(A) 0 N

(B) 5 N

(C) 125 N

(D) 625 N

(E) 1000 N

4. A 2 kg block rests on an inclined plane with an angle of 30°. A steadily increasing force is applied to the block in a direction down the inclined plane until the block begins to move. If the block begins to move when the force reaches 7.3 N, what is the approximate coefficient of static friction between the block and the plane?

(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). How many centimeters is the spring compressed from its relaxed position?

(A) 0.05 cm

(B) 1 cm

(C) 2 cm

(D) 5 cm

(E) 10 cm

6. A sled is pulled at constant velocity across a horizontal surface. If a force of 76.5 N is being applied to the sled rope at an angle of 35.7º to the ground, what is the magnitude of the force of friction?

(A) 12 N

(B) 21 N

(C) 50.2 N

(D) 62.1 N

(E) 80 N

7. A 25 kg mass hangs by a rope. If the tension in the rope is a constant 200 N and the initial velocity of the mass is 3 m/s upwards, what is the velocity of the mass after 2 seconds?

(A) 1 m/s downward

(B) 1 m/s upward

(C) 7 m/s downward

(D) 7 m/s upward

(E) 9.8 m/s upward

8. How much work is done lifting a 377 kg payload from the Earth's surface to a height of 22.7 m above the Earth's surface? (The mass of the Earth is 5.98×1024 kg and the Earth's radius is 6.38×106 m.)

(A) 8.4 kJ

(B) 840 kJ

(C) 42 kJ

(D) 4.2 kJ

(E) 84 kJ

9. A 5 kg ball is attached to a vertical unstretched spring with *k* = 858 N/m and then released. What distance does the ball fall just as it momentarily comes to rest?

(A) 2.884 m

(B) 0.666 m

(C) 0.007 m

(D) 0.008 m

(E) 0.114 m

10. A 2 kg block is dropped from 45 cm above a spring. If the spring compresses 5 cm when struck by the block, what is its spring constant?

(A) 8.3×l0-5 N/m

(B) 4.2×l03 N/m

(C) 7.2×l03 N/m

(D) 1.6×l04 N/m

(E) 400 N/m

11. Which of the following requires the most power?

(A) Lifting 1,000 kg 2 m in 2 s

(B) Lifting 1,500 kg 1.5 m in 2 s

(C) Lifting 2,000 kg 1 m in 2 s

(D) Lifting 2,000 kg 2 m in 4 s

(E) Lifting 3,000 kg 1.4 m in 4 s

12. A machine that produces 80 J of work by using 100 J of energy has an efficiency of

(A) 100 %

(B) 90 %

(C) 40 %

(D) 30 %

(E) 20 %

13. Which of the following would require the greatest force in order to change its velocity by 1 m/s in one second?

(A) A 5 kg ball moving at 9 m/s

(B) A 7 kg ball moving at 7 m/s

(C) A 10 kg ball moving at 5 m/s

(D) A 12 kg ball moving at 4 m/s

(E) A 11 kg ball moving at 4 m/s

14. A ramp is to be constructed so that the force necessary to push a wheelchair to the top of a 1.5 m step is reduced to 0.1 the weight of the wheelchair and its occupant. How long must the ramp be?

(A) 3 m

(B) 10 m

(C) 15 m

(D) 30 m

(E) 45 m

15. The potential a distance *R* from a unit positive point charge is found to be *V*. If the distance between the charge and the point at which the potential is measured is tripled and is now 3*V*, the potential becomes

(A) 3*V*

(B)

(C)

(D) 9*V*

(E) *V*

16. The half life of Cesium-137 is 30.2 years. If the initial amount of a sample of Cesium-137 is of mass 1 kg, how much will remain after 151 years?

(A) 1.000 kg

(B) 0.812 kg

(C) 0.112 kg

(D) 0.988 kg

(E) 0.031 kg

17. An object completely submerged in a fluid with a specific gravity of 3 has an apparent loss of weight of 40 N. If the mass of the object is 12 kg, what is its specific gravity?

(A) 3

(B) 6

(C) 9

(D) 12

(E) 15

18. Object #1 moves toward Object #2, whose mass is twice that of #1, which is at rest. After their head-on impact, the objects lock together and move with what fraction of the Object #l’s initial speed?

(A) 0.25 m/s

(B) 0.33 m/s

(C) 0.50 m/s

(D) 0.67 m/s

(E) 0.45 m/s

19. A block of some unknown material is floating in a fluid of specific gravity 1.5. If one-half of the block is submerged, what is its density?

(A) 400 kg/m3

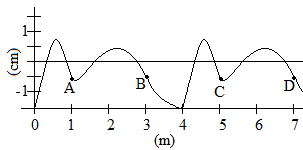
(B) 100 kg/m3

(C) 200 kg/m3

(D) 500 kg/m3

(E) 750 kg/m3

20. What is the approximate wavelength of the wave shown below?



(A) 1 m

(B) 3 m

(C) 4 m

(D) 6 m

(E) 8 m

21. The speed of sound in air is 340 m/s. The sound from a jet moving through air at 100 m/s will move at:

(A) 240 m/s

(B) 340 m/s

(C) 440 m/s

(D) 34,000 m/s

(E) 44,000 m/s

22. A charged particle is moved from a great distance to a distance d from a point charge. At distance d, the electric field has a strength E and a potential V. Which of the following represents the work done per unit charge q?

(A) V

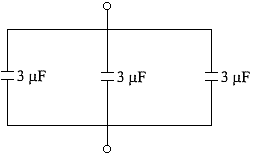
(B) Eqd

(C) Vq

(D) Ed/q

(E) 2Ed/q

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



(A) 

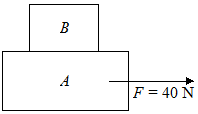
(B) 1

(C) 3

(D) 9

(E) 10

24. A block *B* of mass 5 kg is placed on another block *A* of mass 10 kg, which rests on a smooth horizontal surface. If *µ* = 0.2 between *A* and *B* and a force *F* = 40 N is applied, the acceleration of *A* is:



(A) 3 m/s2

(B) 6 m/s2

(C) 9 m/s2

(D) m/s2

(E) 12 m/s2

25. Two moles of monoatomic ideal gas at 60°C are mixed adiabatically with one mole of another monoatomic ideal gas at 12°C. The final temperature of mixture is:

(A) 22°C

(B) 44°C

(C) 88°C

(D) 36°C

(E) 48°C

26. Two charges *Q*1 and *Q*2 are at rest a distance of 66 cm apart. How much work must be done to slowly move the charges to a separation of 33 cm? (*Q*1 = +6.6×10–9 C and *Q*2 = –3.3×10–9 C)

(A) –2×10–7 J

(B) –3×10–7 J

(C) –2×10–8 J

(D) –3×10–8 J

(E) –4×10–8 J

27. A boat crosses a river with a velocity of 8 km/h. If the resulting velocity of boat is 10 km/h, then the velocity of river water is:

(A) 4 km/h

(B) 6 km/h

(C) 16 km/h

(D) 32 km/h

(E) 64 km/h

28. The potential of a spherical shell carrying 6 µC of charge is 540 kV. What is the radius of the shell?

(A) 0.04 m

(B) 0.05 m

(C) 0.08 m

(D) 0.1 m

(E) 0.5 m

29. For lenses of focal lengths +5 cm, +20 cm, +100 cm and +200 cm are available for making and astronomical telescope. To produce largest magnification, the focal length of the objective (*f*o) and of eye piece (*fe*) should be:

(A) *f*o = +10 cm, *fe* = +5 cm

(B) *f*o = +200 cm, *fe* = +5 cm

(C) *f*o = +100 cm, *fe* = +50 cm

(D) *f*o = +100 cm, *fe* = +5 cm

(E) *f*o = +200 cm, *fe* = +50 cm

30. Two bodies having masses 4 g and 9 g respectively have equal kinetic energies. The ratio of their momenta is:

(A) 16:9

(B) 9:16

(C) 3:2

(D) 2:3

(E) 1:3