Conceptual Questions: Work and Energy

1. A rock sitting at the edge of a cliff contains energy called ----- energy.
   a. potential b. kinetic c. chemical d. radiation e. electrical

2. If the rock falls off of the cliff, it gains energy called ----- energy.
   a. potential b. kinetic c. chemical d. radiation e. electrical

3. Wanda claims that she has invented a machine that will allow a force of 100 N to be exerted, when the operator exerts only 2 N on the machine. This machine violates
   a. conservation of energy b. conservation of momentum c. no physical law

4. Also, Wanda claims that she has invented a machine which continuously puts out 100 units of energy while consuming only 10 units of energy . This machine violates
   a. Conservation of energy b. conservation of momentum c. no physical law

5. A force of **F** is applied to a particle as it moves through a displacement **S**. If **F**=(9**i**+4**j**+3**k**)N, and **S**=(**i**+3**j**-3**k**)m, what is the work done by **F?**
   A. 12J
   B. 6J
   C. –13J
   D. –25J

6. You push a block up a frictionless hill at constant speed. The work done by gravity when you push the block up the hill is equal to (U stands for potential energy)
   a. ΔU
   b. $-\Delta U$
   c. 0
   d. none of the above

7. You push a block up a frictionless hill at constant speed. The work that <u>you</u> do in pushing the block up the hill is equal to
   a. ΔU
   b. $-\Delta U$
   c. 0
   d. none of the above

8. You push a block up a frictionless hill at constant speed. The total work done on the object when you push the block up the hill is equal to
   a. ΔU
   b. $-\Delta U$
   c. 0
   d. none of the above

9. You push a block up a frictionless hill at constant speed. The total work done on your hand when you push the block up the hill is equal to
   a. ΔU
   b. $-\Delta U$
   c. 0
   d. none of the above

10. You push a block up a rough hill at constant speed. The work done by friction when the block is pushed the hill is equal to
    a. ΔU
    b. $-\Delta U$
    c. 0
    d. none of the above

11. The power you must deliver to the block in the above question
    a. increases
    b. decreases
    c. remains constant
    as the distance traveled up the hill increases.

12. A force $F = (3x^2\,\mathbf{i} + 6y\,\mathbf{j})$ N acts on an object as it moves in the x direction from the origin to x = 6.00m, y=0 m and then to x = 6.00m, y=5.00 m. Find the work done on the object by the force.
    a. 145J
    b. 291J
    c. 337J

13. Why is the concept of work important?
    a. Because work describes the position of an object as a function of time.
    b. Because the work done on an object is always independent of the path.
    c. Because the work done on an object depends on its path.
    d. Because work is a form of energy.
    e. Because work provides a link between force and energy.

14. Two marbles, one twice as heavy as the other, are dropped to the ground from the roof of a building. Just before hitting the ground, the heavier marble has
    a. as much kinetic energy as the lighter one.
    b. twice as much kinetic energy as the lighter one.
    c. half as much kinetic energy as the lighter one.
    d. four times as much kinetic energy as the lighter one.
    e. impossible to determine

15. When you jump into the air, the floor does work on you, increasing your kinetic and potential energy. This statement is
    a. True
    b. False

16. A block that is on a table (not frictionless) is pushed to the left by a force equal to 5N. The block moves to the left over a distance of 1m at a constant speed of 2m/s. We can conclude that the total work done by all forces acting on the object is
    a. greater than zero.
    b. less than zero.
    c. equal to zero.
    d. unknown.

17. Balls A, B, and C are thrown off a 45m high cliff. Ball A is thrown horizontally with a speed of 25m/s. Ball B is thrown 25 degrees above the horizontal with a speed of 25m/s. Ball C is thrown 25 degrees below the horizontal with a speed of 25m/s. When the balls hit the ground, we can conclude that (assume no air friction)
    a. ball A hits the ground with the highest speed
    b. ball B hits the ground with the highest speed
    c. ball C hits the ground with the highest speed
    d. they all hit the ground with the same speed

18. If the work done by a force on an object is <u>not</u> zero then the force is said to be
    a. Conservative
    b. Non-conservative
    c. zero
    d. left wing
    e. none of the above

19. Two blocks are released from the top of a height h. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?
    a. The block that went straight down.
    b. The block that went down the ramp.
    c. They both will have the same speed.
    d. Insufficient information to work the problem.

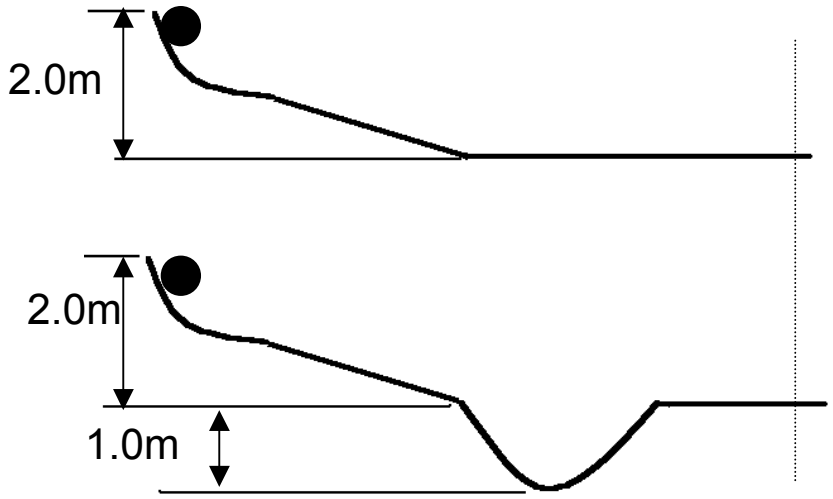
20. Your team of furniture movers wishes to load a truck using a ramp from the ground to the back entrance of the truck. One of the workers claims that less work would be required to load the truck if the length of the ramp were increased since it reduces the angle it makes with the horizontal. You should respond by saying that the ramp helps because
    a. the required work is the same but the required force decreases.
    b. the required work increases but the required force stays the same.
    c. the required work decreases but the required force increases.
    d. the required work is the same but the required force increases.
    e. the required work decreases and the required force decreases .

21. A woman runs up a flight of stairs. The gain in her gravitational potential energy is U. If she runs up the stairs at half the speed, her gain in gravitational potential energy will be
    a. U/4
    b. U/2
    c. U
    d. 2U
    e. 4U

22. An object of mass m moves with a velocity v across a level surface. It comes to rest after traveling a distance d. The work done by friction is
    a. $-1/2mv^2$
    b. -mvd
    c. 0
    d. Can't be determined unless we know the coefficient of kinetic friction.

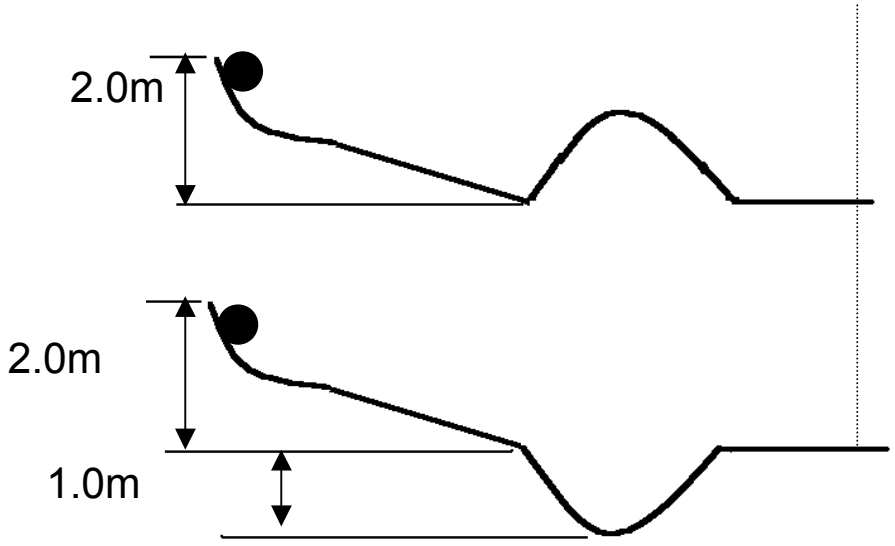
23. An object of mass m moves is in uniform circular motion across a level surface. Its speed is v. The work that friction does done in keeping the car in a circular path is
    a. $-1/2mv^2$
    b. -mvd
    c. 0
    d. Can't be determined unless we know the coefficient of kinetic friction.

24. Two objects, both at rest, are released from the same initial height and follow the paths shown toward the dotted line. Which object will have the higher average speed between the initial and final points?



    a. The one in the top figure
    b. The one in the bottom figure.
    c. They reach the bottom at the same time.

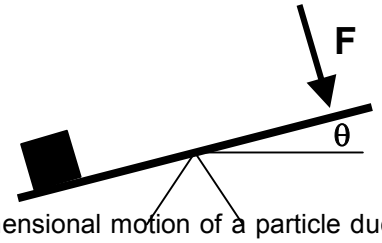
25. Two objects, both at rest, are released from the same initial height and follow the paths shown. Both tracks are smooth and of equal length. Which object reaches the dotted line first?



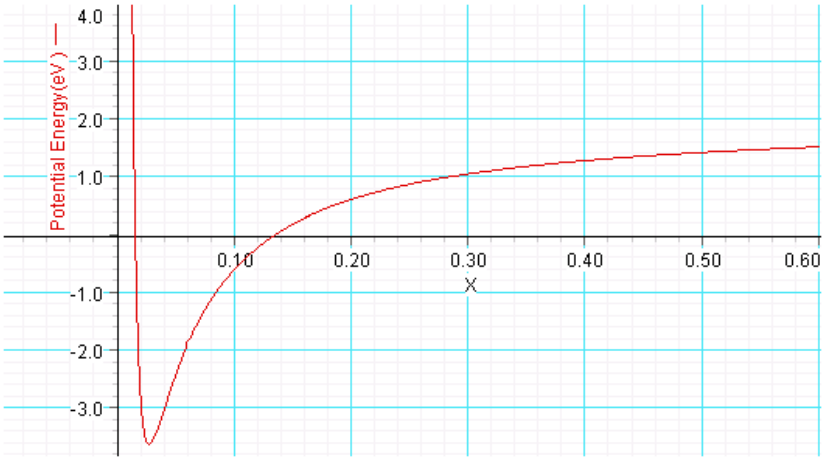
a. The one in the top figure
b. The one in the bottom figure.
c. They reach the bottom at the same time.

26. A cart of mass m is pulled a distance d up an incline plane of angle θ. The string mages an angle α with the incline plane. The tension in the string is T. After traveling the distance d its speed is v. Assuming the cart started from rest the work done by friction is
    a. $-1/2mv^2$
    b. $-T\cos\alpha+mgdcos(90+\theta)$
    c. $-T\cos\alpha+mgdsin\theta+1/2mv^2$
    d. $-T\cos(\alpha+\theta)-mgdsin\theta+1/2mv^2$
    e. Can't be determined unless we know the coefficient of kinetic friction

27. A force F is applied to the see saw. F is applied a distance 2d from the pivot point, and the mass is a distance d from the pivot point. Compare the work done by gravity and the work done by the force F when the see saw is displaced through the angle θ.
    a. the work done by gravity is greater than the work done by F.
    b. the work done by gravity is less than the work done by F.
    c. the work done by gravity the same as the work done by F.



The diagram below pertains to the next 3 questions. Consider the one-dimensional motion of a particle due to a force with the associated potential energy function shown below. As x approaches infinity the potential energy approaches 2eV ($1eV=1.6x10^{-19}J$) The units on the horizontal axis are in nanometers ($1nm=10^{-9}m$).



28. If the total energy of the particle equals 3eV, the motion of the particle is
    a. bound between x=0.02nm-0.30nm
    b. bound between x=0.02nm-0.30nm, and x=0.40nm-infinity
    c. bound between x=0.02nm-0.30nm, and x=0.0nm-0.02nm
    d. unbound, there are no restrictions to its motion

29. If the total energy of the particle equals 1eV, the motion of the particle is
    a. bound between x=0.02nm-0.30nm
    b. bound between x=0.02nm-0.30nm, and x=0.40nm-infinity
    c. bound between x=0.02nm-0.30nm, and x=0.0nm-0.02nm
    d. unbound, there are no restrictions to its motion

30. If the kinetic energy of the particle is 2 eV at x=0.06nm, the force on the particle is greatest at which of the following locations.
    a. 0.13nm
    b. 0.06nm
    c. 0.03nm
    d. 0.02nm

31. Two identical objects are accelerated through the same distance by different forces such that one object gains a velocity twice that of the other object. One can conclude that the force on the faster object is
    a. One-fourth that of the slower object
    b. Half that of the slower object
    c. The same as that of the slower object.
    d. Twice that of the slower object
    e. Four times that of the slower object