# A.P. "C" Energy Practice

1. A body moves with decreasing speed. Which of the following statements is true?

   a. The net work done on the body is positive, and the kinetic energy is increasing.
   b. The net work done on the body is positive, and the kinetic energy is decreasing.
   c. The net work done on the body is zero, and the kinetic energy is decreasing.
   d. The net work done on the body is negative, and the kinetic energy is increasing.
   e. The net work done on the body is negative, and the kinetic energy is decreasing.

2. The SI unit of energy can be expressed as

   a. $kg \cdot m/s$ b. $kg \cdot m/s^2$ c. $m/(kg \cdot s)$
   d. $kg \cdot m \cdot s^2$ e. none of these.

3. The average marathon runner can complete the 42.2-km distance of the marathon in 3 h and 30 min. If the runner's mass is 75 kg, what is the runner's average kinetic energy during the run?

   a. 842 J b. $5.45 \times 10^3$ J c. 251 J d. 126 J e. 421 J

4. The work expended to accelerate a car from 0 to 30 m/s

   a. is more than that required to accelerate it from 30 m/s to 60 m/s.
   b. is equal to that required to accelerate it from 30 m/s to 60 m/s.
   c. is less than that required to accelerate it from 30 m/s to 60 m/s.
   d. can be any of the preceding, depending on the time taken.
   e. is described by none of these statements.

5. The kinetic energy of a car is $1.00 \times 10^5$ J. If the car's speed is increased by 20 percent, the kinetic energy of the car becomes

   a. $4.00 \times 10^3$ J
   b. $1.20 \times 10^5$ J
   c. $1.44 \times 10^5$ J
   d. $1.04 \times 10^5$ J
   e. unknown; the answer depends on the mass of the car, which is not given.

6. A bullet with a mass of 12 g moving horizontally strikes a fixed block of wood and penetrates a distance of 5.2 cm. The speed of the bullet just before the collision is 640 m/s. The average force that the wood exerted on the bullet was

   a. $4.7 \times 10^4$ N
   b. 74 N
   c. $4.7 \times 10^6$ N
   d. unknown; the mass of the wood is required.
   e. none of these.

7. If you double the speed of an object, its kinetic energy is

a. the same. b. doubled. c. tripled. d. quadrupled. e. halved.

8. A force **F** pushes a block along a horizontal surface against a force of friction $\mathbf{F}_f$. If the block undergoes a displacement **s** at constant velocity, the work done by the resultant force on the block

a. is equal to the work done by the force of friction $\mathbf{F}_f$.
b. is given by $W = \mathbf{F} \cdot \mathbf{s}$.
c. increases the kinetic energy of the block.
d. increases the potential energy of the block.
e. is zero.

9. A variable force is represented on an F-versus-x graph. Which of the following is the work done by this force?

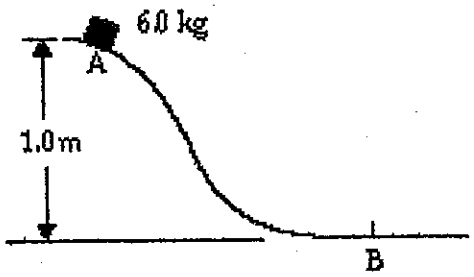
a. the slope of the curve
b. the area bounded by the curve and the x axis
c. the area bounded by the curve and the F axis
d. the F value multiplied by the x value
e. the F value divided by the x value

10. A particle that is subjected to a variable force travels a distance of 20 m in a straight line in the same direction as the force. The force varies as follows:

First, 5.0 m and F = 0
Next, 5.0 m and F = 3.0 N
Next, 5.0 m and F = 6.0 N
Last, 5.0 m and F decreases uniformly from 6.0 N to zero.

What was the total work done by this force during the full 20-m trip?

a. 15 J b. 30 J c. 45 J d. 60 J e. 75 J

11. 


A 6.0-kg block slides from rest at position A down a frictionless incline to position B. The speed of the block at B is

a. 3.1 m/s b. 4.4 m/s c. 11 m/s d. 1.8 m/s e. 20 m/s

12. A woman runs up a flight of stairs. The gain in her gravitational potential energy is U. If she runs up the same stairs with twice the speed, what is her gain in potential energy?

a. U  b. 2U  c. $\frac{1}{2}$U  d. 4U  e. $\frac{1}{4}$U

13. The reference point for gravitational potential energy

a. must be at the initial position of the object.
b. must be at the final position of the object.
c. must be at ground level.
d. must be at the lowest position ever reached by the object.
e. can be chosen arbitrarily.

14. Which of the following statements is true?

a. The kinetic and potential energies of an object must always be positive quantities.
b. The kinetic and potential energies of an object must always be negative quantities.
c. Kinetic energy can be negative but potential energy cannot.
d. Potential energy can be negative but kinetic energy cannot.
e. None of these statements is true.

15. A 75-kg man climbs the stairs to the fifth floor of a building, a total height of 16 m. His potential energy has increased by

a. $1.2 \times 10^4$ J  b. $5.9 \times 10^4$ J  c. $4.7 \times 10^4$ J  d. $3.8 \times 10^4$ J  e. $5.9 \times 10^3$ J

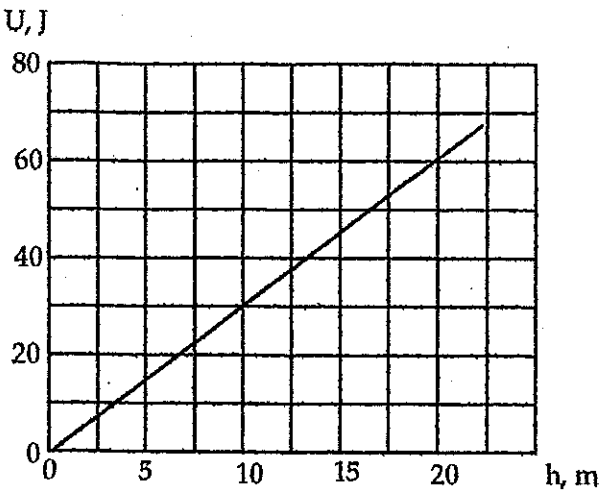
16. A spring with force constant k = 300 N/m is compressed 9.0 cm. What is the potential energy in the spring?

a. $1.2 \times 10^4$ J  b. 2.4 J  c. $2.7 \times 10^4$ J  d. 27 J  e. 1.2 J

17. Which of the following statements is true?

a. Friction is a conservative force and does negative work.
b. Potential energy may be defined by the equation U(x) = -dF(x)/dx
c. The work done by a conservative force between two points depends on the path taken between those points.
d. A conservative force cannot change a body's total energy.
e. The work done by a conservative force while a body moves at constant velocity must be zero.

18.




The graph shows a plot of the gravitational potential energy U of a 1-kg body as a function of its height h above the surface of a planet. The acceleration due to gravity at the surface of the planet is

a. 0 m/s$^2$ b. 9.8 m/s$^2$ c. 6.0 m/s$^2$
d. 3.0 m/s$^2$ e. none of these.

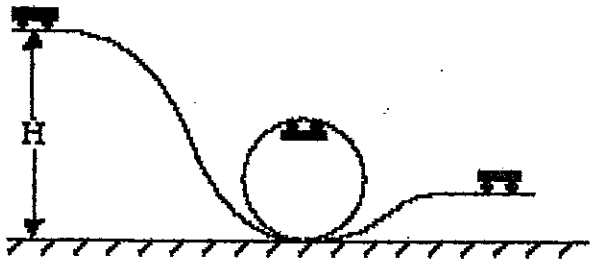
19. The total mechanical energy of any system is

a. always the work done by gravity.
b. the difference between the kinetic and potential energy at any point.
c. the sum of the kinetic and potential energy at any point.
d. the sum of the translational and rotational kinetic energies at any point.
e. the potential energy of a spring at any displacement.

20. A projectile of mass m is propelled from ground level with kinetic energy of 450 J. At the exact top of its trajectory, its kinetic energy is 250 J. To what height above the starting point does the projectile rise?

a. $\frac{450}{mg}$ m b. $\frac{250}{mg}$ m c. $\frac{700}{mg}$ m d. $\frac{200}{mg}$ m e. $\frac{350}{mg}$ m

21.




You ride a roller coaster car of mass 1500 kg down a frictionless track a distance H = 23 m above the bottom of a loop as shown. If the loop is 15 m in diameter, the downward force of the rails on your car when it is upside down at the top of the loop is

a. $4.6 \times 10^4$ N b. $3.1 \times 10^4$ N c. $1.7 \times 10^4$ N d. 0.98 kN e. $1.6 \times 10^3$ N

22. A woman on a bicycle traveling at 10 m/s on a horizontal road stops pedaling as she starts up a hill inclined at 3.0° to the horizontal. If friction forces are ignored, how far up the hill does she travel before stopping?

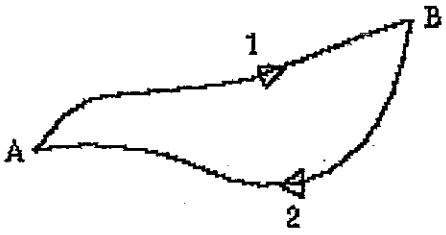
a. 5.1 m
b. 30 m
c. 97 m
d. 10 m
e. The answer depends on the mass of the woman.

23. A child is sitting on the seat of a swing with ropes 10.0 m long. Her father pulls the swing back until the ropes make a 37° angle with the vertical and then releases the swing. If air resistance is neglected, what is the speed of the child at the bottom of the arc of the swing when the ropes are vertical?

a. 11 m/s b. 8.8 m/s c. 14 m/s d. 6.3 m/s e. 12 m/s

24. A 5-kg box is pushed 5 m up a plane that is inclined at 30° with the horizontal. The coefficient of kinetic friction between the box and the plane is 0.20. The change in potential energy of the box is approximately

a. 12.5 J b. 34.2 J c. 123 J d. 345 J e. 403 J

25. 


Consider a motion in which a particle goes from A → B along path 1 and from B back to A along path 2, as shown.

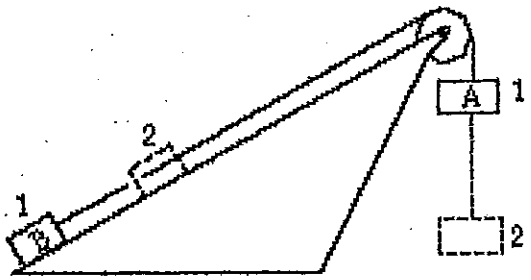
W(AB, 1) = work in going from A → B along path 1.
W(BA, 2) = work in going from B → A along path 2.

If only conservative forces are acting, then

a. W(AB, 1) > W(BA, 2) b. W(AB, 1) < W(BA, 2) c. W(AB, 1) + W(BA, 2) > 0
d. W(AB, 1) + W(BA, 2) < 0 e. W(AB, 1) + W(BA, 2) = 0

26. A 4.0-kg block starts from rest and slides 5.0 m down a plane inclined at 60° to the horizontal. The coefficient of kinetic friction between the surface and the block is 0.20. The work done by friction on the block is

a. 98.0 J b. 19.6 J c. 3.92 J d. 3.40 J e. 64.0 J

27. 


A system comprising two blocks is shown, one of which is on an inclined plane. The pulley is of negligible mass and is frictionless. The system starts from rest at position 1 and accelerates. Measurements taken when the blocks reach position 2 indicate that

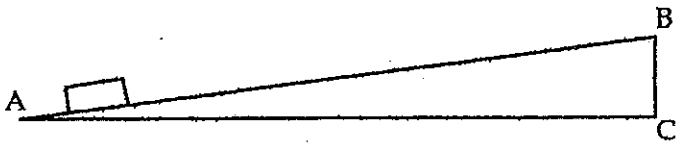
(1) the kinetic energy of block A has changed by 330 J,
(2) the potential energy of block A has changed by 588 J,
(3) the kinetic energy of block B has changed by 110 J, and
(4) the potential energy of block B has changed by 98 J.

The amount of mechanical energy that has been converted to heat because of friction is

a. 12 J b. 50 J c. 258 J d. 478 J e. 710 J

28. Consider two engines. The larger is rated at 2 W and the smaller at 1 W. The smaller one can do a certain quantity of work in 2 h. The larger can do twice as much work in a time of

a. 30 min b. 1 h c. 2 h d. 4 h e. 1.4 h

29. 


The object in the figure has a mass of 3.45 kg and is pulled up a slope AB, which is 36 m long; the height BC is 3.00 m. There is no friction and the acceleration is constant. The speed $v_1$ at A is 3.5 m/s whereas the speed $v_2$ at B is 5.5 m/s. The average power developed by the motor pulling the object is

a. 17 W b. 3.9 W c. 13 W d. 0.13 kW e. 43 W

30. Power P is required to do work W in time interval t. What power is required to do work 3W in time interval 5t?

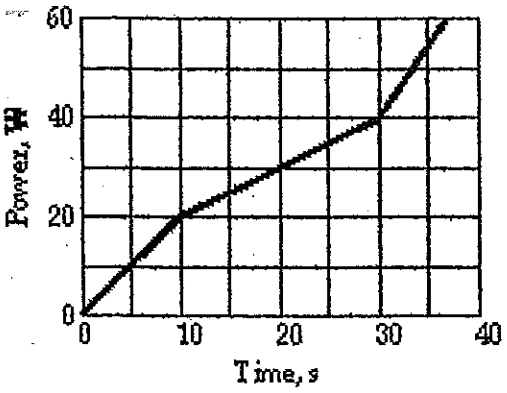
a. P b. 3P c. 5P d. 5P/3 e. 3P/5

31. The power developed by a certain engine is a function of time according to

$$P = 2 + 2t + 3t^2$$

where the units are SI. The work done by the engine in the interval from t = 0 to t = 2 s is

a. 9 J b. 10 J c. 14 J d. 16 J e. 18 J

32. 


A motor develops power as shown in the graph. The energy expended by the motor in the time interval between t = 10 s and t = 30 s is

a. 1.0 J b. 1.3 J c. 0.20 kJ d. 0.60 kJ e. 0.70 kJ

33. A force **F** acts on a body and produces an acceleration **a**. The body undergoes a displacement **s** and attains a velocity **v** in time **t**. The instantaneous power being developed at time t is given by

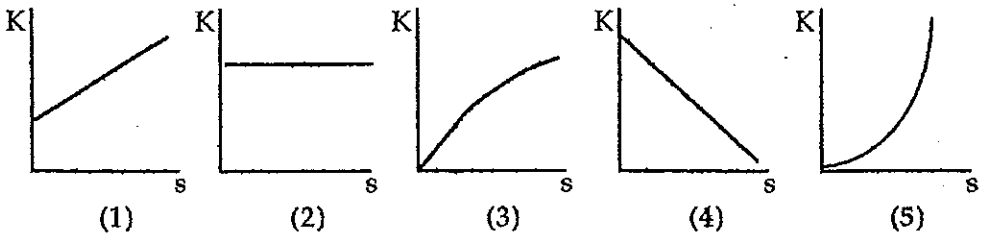
a. $\mathbf{F} \cdot \mathbf{v}$ b. $\mathbf{F} \cdot \frac{1}{2}\mathbf{a}t^2$ c. $\mathbf{F} \cdot \mathbf{a}$ d. $(\mathbf{F} \cdot 2\mathbf{s})/t^2$ e. $\mathbf{F} \cdot \mathbf{s}$

34. A block slides a certain distance down an incline. The work done by gravity is W. What is the work done by gravity if this block slides the same distance up the incline?

a. W
b. zero
c. -W
d. Gravity cannot do work; some other force does the work.
e. The work cannot be determined unless the distance traveled is given.

35. A 5-kg object slides down a frictionless surface inclined at an angle of 30° from the horizontal. The total distance moved by the object along the plane is 10 meters. The work done on the object by the normal force of the surface is

a. zero b. 0.50 kJ c. 0.43 kJ d. 0.58 kJ e. 0.25 kJ

36. 


You release an object from rest at a high altitude. If air resistance is considered, the curve that best represents the kinetic energy of the body as a function of the distance fallen is

a. 1 b. 2 c. 3 d. 4 e. 5

37. Power P is required to lift a body a distance d at a constant speed v. What power is required to lift the body a distance 2d at constant speed 3v?

a. P b. 2P c. 3P d. 6P e. 3P/2

38. To maintain an automobile in approximately constant acceleration, its engine must develop power that increases with time. Suppose that in one situation the work done by an engine is given by

$$W = 7000t^2 + 40{,}000t + 100{,}000$$

where the units are SI. The power developed by this engine at t = 2 s is

a. $3.4 \times 10^4$ W b. $6.8 \times 10^4$ W c. $1.0 \times 10^5$ W d. $2.1 \times 10^5$ W e. $3.0 \times 10^5$ W