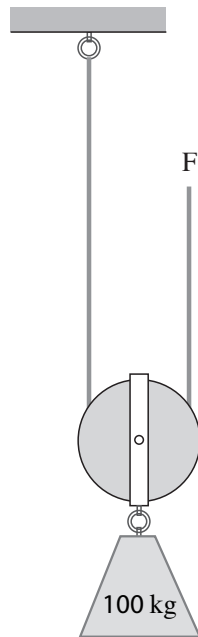


## Work & Energy Practice Items

- The translational kinetic energy of a moving body at a given instant depends on . . .
  - its weight
  - its heat content
  - the forces acting on it
  - its speed
- With regard to the work performed by the centripetal force upon an object undergoing uniform circular motion
  - the centripetal force performs no work upon the object.
  - the amount of work performed by the centripetal force in one revolution equals the magnitude of the force times the circumference of the circle.
  - the amount of work performed by the centripetal force equals the change in the kinetic energy of the object.
  - more than one of the above is correct.
- A 5-kg brick falls from a scaffolding. Ignoring the effects of air friction, what is its kinetic energy 2 seconds later?
  - 10 J
  - 100 J
  - 250 J
  - 1000 J
- A crane lifts a 1000-kg automobile 10 meters off the ground. Discounting friction, how much work is performed?
  - 10,000 J
  - 15,000 J
  - 100,000 J
  - 150,000 J
- Even if there were no drag from the air, a pilot should know that the amount of jet-fuel required to bring about an acceleration from 150 to 300 m/s is
  - half the amount required to accelerate from 75 to 225 m/s.
  - equal to the amount required to accelerate from 75 to 225 m/s divided by the square root of 2.
  - equal to the amount required to accelerate from 75 to 225 m/s.
  - greater than the amount required to accelerate from 75 to 225 m/s..
- Which of the following illustrates conservation of mechanical energy?
  - A gun recoils when fired.
  - An iceberg floats with only one-tenth of its volume above water.
  - In sliding to a stop, the friction of an automobile's tires heat up the road.
  - In a vacuum chamber, the bob of a perfectly frictionless pendulum is released and returns to exactly the same point.

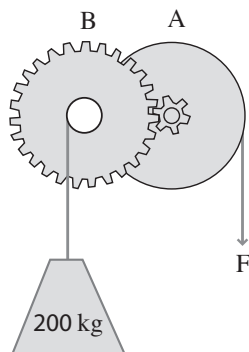
7. What is the mechanical advantage of the pulley system pictured below?

- A. 1
- B. 2
- C. 3
- D. 4



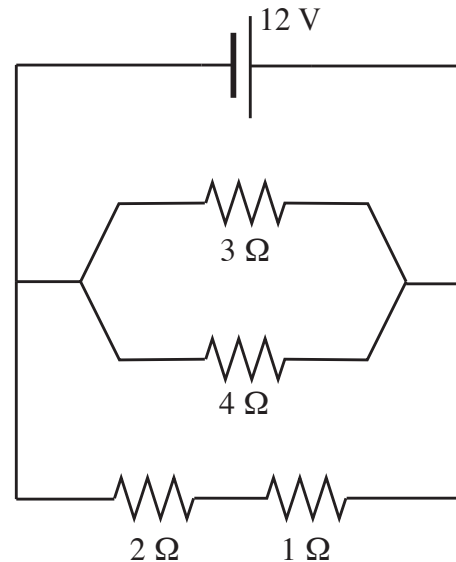
8. In the gear train below the radii of gear A and belt pulley is 20cm and the shaft of gear B and belt pulley is 5cm. Gear A has 6 teeth and gear B has 30 teeth. What minimum force **F** must be exerted to lift the mass of 200-kg?

- A. 100N
- B. 400N
- C. 500N
- D. 2000N



9. In traveling through the circuit depicted in the diagram below, a positive charge has three alternative pathways of movement from the positive pole to the negative pole of the voltage source. The charge could move either through the  $3\Omega$  resistor, the  $4\Omega$  resistor, or through the combination of  $1\Omega$  and  $2\Omega$  resistors. Which pathway represents the greatest decrease in electrostatic potential energy for the charge?

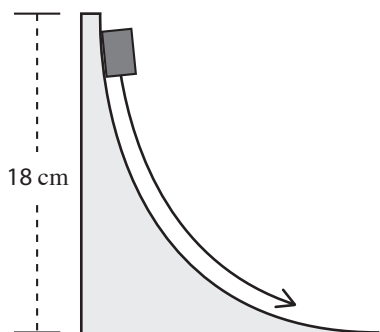
- A. through the  $3\Omega$  resistor
- B. through the  $4\Omega$  resistor
- C. through the combination of the  $1\Omega$  and  $2\Omega$  resistors
- D. the electrostatic potential energy decrease is the same for the three pathways



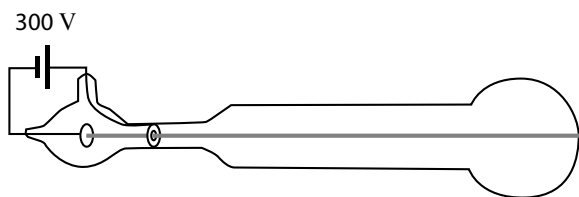
10. All of the following statements are correct concerning work *except*...

- A. Work can be expressed as the product of the force times the component of displacement in the direction of the force
- B. A kinetic friction force performs no work.
- C. If performed by conservative forces, the amount of work does not depend on the path taken to reach a certain state.
- D. The work performed equals the product of the power at which a mechanical system is operating and the duration of time.

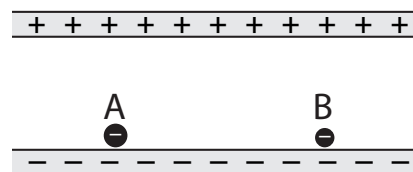
11. A block is released from rest to slide down the frictionless surface as pictured below. The block achieves a final speed of
- A. 0.6 m/s
  - B. 1.9 m/s
  - C. 3.6 m/s
  - D. 6.0 m/s



12. What is the electron speed in the cathode ray tube shown below? (Electron mass =  $9.11 \times 10^{-31}$  kg;  $1 \text{ eV} = 1.60 \times 10^{-19}$  J)
- A.  $1.6 \times 10^5$  m/s
  - B.  $9.1 \times 10^5$  m/s
  - C.  $2.5 \times 10^6$  m/s
  - D.  $1.1 \times 10^7$  m/s



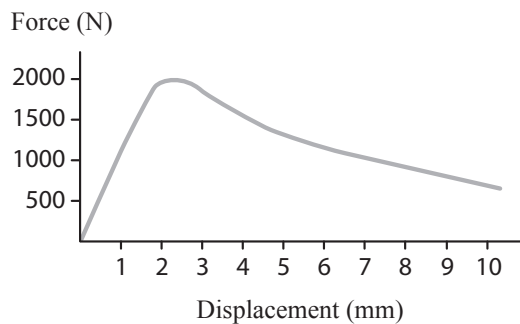
13. As shown in the figure below, two charged plates containing uniform distributions of opposite charge are separated by a distance much smaller than the size of the plates. Two negatively charged particles are released from a position near the negative plate into the space between the two plates. The two particles possess equal charge, but particle A is 4 times as massive as particle B. Particle B is observed to strike the positive plate first moving at speed  $v_B$ , followed later by particle A moving at speed  $v_A$ . Which of the following describes the relationship between the speeds  $v_A$  and  $v_B$ ?



- A.  $v_A = 0.25 v_B$
  - B.  $v_A = 0.50 v_B$
  - C.  $v_A = 0.71 v_B$
  - D.  $v_A = v_B$
14. A 100 kg stone block slides down a ramp of height 10 meters. At the end of the slide, which lasts 4 seconds, the block's speed is 8 m/s. What is the average power delivered by the friction force of the ramp during the slide?
- A. 320 W
  - B. 1250 W
  - C. 1700 W
  - D. 3200 W

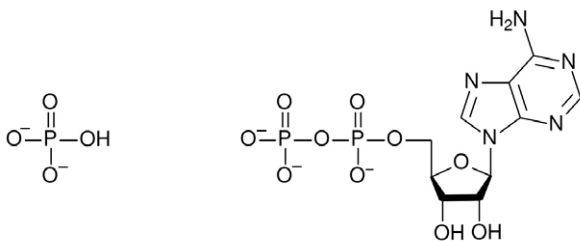
15. A dynamic hip screw (DHS) is a type of orthopedic implant designed for fixation of certain types of hip fractures in which the femoral head component is allowed to move along one plane. The figure below shows the compressive force vs. displacement graph for a particular DHS. Which of the following most closely approximates the amount of energy required to displace the femoral head component of this DHS a distance of 1 cm?

- A. 1 J  
 B. 4 J  
 C. 12 J  
 D. 20 J



16. When a hydrogen phosphate molecule moves nearer to a molecule of ADP within an aqueous solution environment, this represents

- A. an electrostatic potential energy increase  
 B. mechanical work by actin and myosin  
 C. a decrease in internal energy  
 D. heat flow



17. To overcome rolling friction and pull rail cars of mass  $4.0 \times 10^6$  kg at a constant velocity of 36 km/hr a locomotive provides 3000 kW of power. What force does the locomotive exert on the rail cars?

- A. 0 N  
 B.  $1.4 \times 10^4$  N  
 C.  $8.3 \times 10^4$  N  
 D.  $3.0 \times 10^5$  N

18. To belay in rock climbing is to pull the rope in as another climber ascends below so that the climber will be safe. In the figure below, a 120kg man is belaying on level ground far back from the cliff-edge for a 100kg man hanging in mid-air below. The belaying man above begins sliding towards the cliff-edge, though doesn't fall over the edge. His friend drops 15m to the ground while he's sliding. The coefficient of kinetic friction between the belayer and the cliff surface is 0.8. At what approximate speed does his friend strike the ground below?

- A. 7.7 m/s  
 B. 10.0 m/s  
 C. 12.2 m/s  
 D. 15.3 m/s



19. The only chemical elements that form stable two-atom homonuclear molecules at standard temperature and pressure (STP) are hydrogen ( $\text{H}_2$ ), nitrogen ( $\text{N}_2$ ) and oxygen ( $\text{O}_2$ ), plus the halogens fluorine ( $\text{F}_2$ ) and chlorine ( $\text{Cl}_2$ ). In the gaseous state these molecules possess kinetic energy at the particle level, ie. thermal energy, in a variety of partitions corresponding to
- A. vibration along the bond axis
  - B. rotation
  - C. translational motion
  - D. all of the above
-