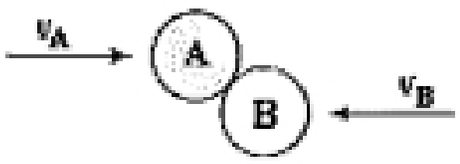
MULTIPLE CHOICE QUESTIONS (equal weight):

1. Two people, each of 70 kg mass, are riding in an elevator. One is standing on the floor. The other is hanging on a rope suspended from the ceiling. Compare the force $\vec{F}_F$ the floor exerts on the first person to the force $\vec{F}_R$ the rope exerts on the second person. Which statement is correct?
   a. They are equal and opposite in direction.
   b. They are equal and have the same direction.
   c. $\vec{F}_R$ is greater than $\vec{F}_F$, but they have the same direction.
   d. $\vec{F}_R$ is greater than $\vec{F}_F$, but they have opposite directions.
   e. $\vec{F}_R$ is less than $\vec{F}_F$, but they have the same direction.

2. You throw a ball up in the air and hold your hand under it to catch it when it comes down. The reason why the ball stops is because
   a. your hand is there: your hand exerts no force on the ball.
   b. your hand exerts a force on the ball perpendicular to its velocity.
   c. your hand exerts a force on the ball in the direction of its velocity.
   d. your hand exerts a force on the ball in the direction opposite to its velocity.
   e. your hand and the ball exert forces in the same direction on each other.

3. Two bodies, A and B, collide as shown in Figures I and II below.

I



II

   Which statement is true?
   a. They exert equal and opposite forces on each other in I but not in II.
   b. They exert equal and opposite force on each other in II but not in I.
   c. They exert equal and opposite force on each other in both I and II.
   d. The forces are equal and opposite to each other in I, but only the components of the forces parallel to the velocities are equal in II.
   e. The forces are equal and opposite in I, but only the components of the forces perpendicular to the velocities are equal in II

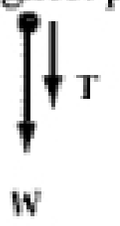
4. A student is sitting on the right side of a school bus when it makes a right turn. We know that the force of gravity acts downwards and a normal force from the seat acts upwards. If the student stays in place when the bus turns, we also know that there must be
   a. no other force on the student.
   b. a force parallel to the seat directed forward on the student.
   c. a force parallel to the seat directed to the left on the student.
   d. a force parallel to the seat directed to the right on the student.
   e. a force parallel to the seat in a direction between forward and left on the student.

5. When a car goes around a circular curve on a level road without slipping,
   a. no frictional force is needed because the car simply follows the road.
   b. the frictional force of the road on the car increases when the car's speed decreases.
   c. the frictional force of the road on the car increases when the car's speed increases.
   d. the frictional force of the road on the car increases when the car moves to the outside of the curve.
   e. there is no net frictional force because the road and the car exert equal and opposite forces on each other.

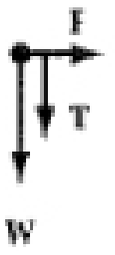
6. A rock attached to a string swings in a vertical circle. Which free body diagram could correctly describe the force(s) on the rock when it is at the highest point?

a. 

b. 

c. 

d. 

e. 

7. An airplane flies in a horizontal circle of radius 500 m at a speed of 150 m/s. If the plane were to fly in the same 500 m circle at a speed of 300 m/s, by what factor would its centripetal acceleration change?
   a. 0.25
   b. 0.50
   c. 1.00
   d. 2.00
   e. 4.00

8. What is the net force on a 10-kg solid steel sphere falling in air at terminal speed?
   a. 980 N
   b. 200 N
   c. 98 N
   d. 49 N
   e. Some value other than those given above.

9. Carts A and B have equal masses and travel equal distances on straight frictionless tracks while a constant force F is applied to A, and a constant force 2F is applied to B. The relative amounts of work done by the two forces are related by
   a. $W_A = 4\ W_B$.
   b. $W_A = 2\ W_B$.
   c. $W_A = W_B$.
   d. $W_B = 2\ W_A$.
   e. $W_B = 4\ W_A$.

10. When a crate of mass m is dragged a distance d along a surface with coefficient of kinetic friction μ_k, then dragged back along the same path to its original position, the work done by friction is
    a. 0.
    b. $-\mu_k mgd$.
    c. $+\mu_k mgd$.
    d. $-2\mu_k mgd$.
    e. $+2\mu_k mgd$.

11. Two cannonballs are dropped from a second floor physics lab at height h above the ground. Ball B has four times the mass of ball A. When the balls pass the bottom of a first floor window at height $\frac{h}{4}$ above the ground, the relation between their kinetic energies, K_A and K_B, is
    a. $K_A = 4K_B$.
    b. $K_A = 2K_B$.
    c. $K_A = K_B$.
    d. $K_B = 2K_A$.
    e. $K_B = 4K_A$.

12. Sally, who weighs 450 N, stands on a skate board while Roger pushes it forward 13.0 m at constant velocity on a level straight street. He applies a constant 100 N force.
    a. The work Roger does on the skateboard is 0 J.
    b. The work Roger does on the skateboard is 1 300 J.
    c. The work Sally does on the skateboard is 1 300 J.
    d. The work Sally does on the skateboard is 5 850 J.
    e. The work Roger does on the skateboard is 5 850 J.

13. A particle is acted upon by only two forces, one conservative and one non-conservative and neither being a force of friction, as it moves from point A to point B. The kinetic energies of the particle at points A and B are equal if
    a. the sum of the works of the two forces is zero.
    b. the work of the conservative force is equal to the work of the nonconservative force.
    c. the work of the conservative force is zero.
    d. the work of the nonconservative force is zero.
    e. None of the above.

14. A small lead sphere of mass m is hung from a spring of spring constant k. The gravitational potential energy of the system equals zero at the equilibrium position of the spring before the weight is attached. The total mechanical energy of the system when the mass is hanging at rest is
    a. $-kx^2$. b. $-\frac{1}{2}kx^2$. c. 0. d. $+\frac{1}{2}kx^2$. e. $+kx^2$

15. A pendulum bob has potential energy U_0 when held taut in a horizontal position. The bob falls until it is 30° away from the horizontal position, when it has potential energy U_A. It continues to fall until the string is vertical, when it has potential energy U_B. Compare its potential energies at O, A, and B.
    a. $U_0 = U_A = U_B$.
    b. $U_A - U_B = 2U_0$.
    c. $U_A - U_B = U_0 - U_A$.
    d. $U_0 = U_B = 2U_A$.
    e. $U_0 - U_A = 2(U_A - U_B)$.