Midterm Exam. (Fall 2017), General Phys. (I), CS152.
[the sum of all points is 113, the exam score is 100 points if the sum of all points is greater than 100]

1. Define/explain/describe the following items (using figures if necessary), (20 pts)
    (a) Force, (b) Work energy theorem, (c) Conservative force, (d) Conservation of mechanical energy,
    (e) Universal Gravitation. (f) Center of mass, (g) Elastic collisions,
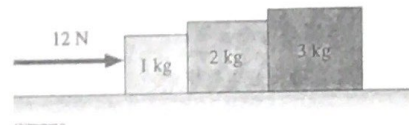   (h) Angular momentum, (i)Torque, (j)Rotational energy.

2. Please write down and describe Newton's 1st, 2nd and 3rd laws. (6 pts)

3. Blocks of 1, 2 and 3 kg are lined up on a frictionless table, as shown
    in Fig. 1, with a 12-N force applied to the leftmost block. Find

Fig.1

    (a) the acceleration of the rightmost block, (5 pts)
    (b) the magnitude of the force that the rightmost block exerts on the middle one, and (5 pts)
    (c) the net force on the first block. (5 pts)

4. Find (a) the total work done by the force shown in Fig. 2 as the object on
    which it acts moves from x = 0 to x = 3 km, and (5 pts)
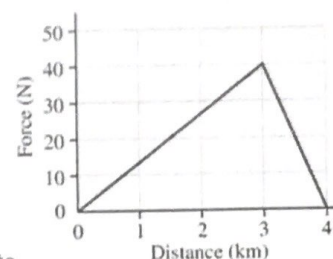   (b) the kinetic energy gained by the object at 3 km. (5 pts)

5. A particle slides along the frictionless track shown in Fig. 3, starting at rest
    from point A. Find (a) its speed at B, (b) its speed at C, and (c) the approximate
    location of its right-hand turning point. (15pts)

Fig. 2

6. An object collides elastically with an equal-mass object initially at rest.
    (a) Which one is still conserved during the collision?(Total kinetic energy or total momentum or both.) (2pts)
    (b) If the collision isn't head-on, show that the final velocity vectors are perpendicular. (5 pts)

7. What fraction of a solid disk's kinetic energy is rotational if it's
    rolling without slipping? (5 pts)

8. A particle undergoes simple harmonic motion with maximum speed
    1.8 m/s and maximum acceleration 3.1 m/s^2. Find the
    (a) angular frequency, (b) period, and (c) amplitude. (15 pts)
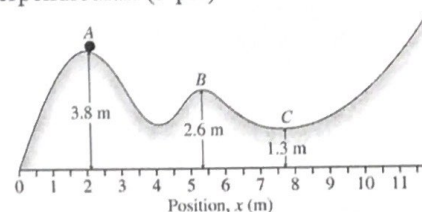
Fig. 3

9. Satellites move around the Earth. What are the possible orbits for   (6 pts)
    (a) $E < 0$, (b) $E = 0$, and (c) $E > 0$, where E is the total energy (= kinetic energy + potential energy)

10. (a) Write down the conditions for static equilibrium. (in terms of force.) (4 pts)
     (b) Write down the conditions for stable equilibrium. (in terms of the potential energy.) (4 pts)

11. When the external force on a system of particles is zero, please write down 3 of the conservation laws of
     this system. (6 pts)