

University of Bucharest Faculty of Physics - Admission 2026 Mechanics Quiz	Items 1-10 have a single correct answer Items 11 and 12 will be solved in detail N_1 = total points for items 1-10 + 1p ex officio N_2 = total points for items 11 and 12 + 1p ex officio Final grade: $N = 0.6 \times N_1 + 0.4 \times N_2$
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Note: Gravitational acceleration is considered to be $g=10\text{ m/s}^2$.

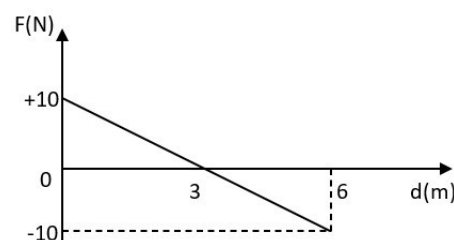
Exam duration : 2 hours.

1. (0.9p) The unit of measurement $\text{kg} \cdot \text{m}^2/\text{s}^3$ can be considered the unit of measurement for:

- A) mechanical work B) power C) force D) speed

2. (0.9p) A body moves under the action of a resultant force acting along the direction of motion. The variation of the force with the distance traveled is shown in the graph. The work done by the force over the distance (0 – 6) m is:

- A) 10 J B) 20 J C) 0 J D) 15 J



3. (0.9p) The theorem of the variation of the kinetic energy of a material point considers the mechanical work:

- A) of active forces B) of all forces acting on the material point
C) of conservative forces D) of non-conservative forces

4. (0.9p) An elastic thread has the constant of elasticity $k=300\text{ N/m}$. A piece of the thread equal to one third of the total length of the undeformed thread is cut. The elastic constant of the remaining part of the thread is:

- A) 450 N/m B) 600 N/m C) 550 N/m D) 400 N/m.

5. (0.9p) A body falls freely from a height H , measured relative to the ground. The kinetic and potential energy are equal at the height:

- A) $3H/4$ B) $H/3$ C) $3H/7$ D) $H/2$

6. (0.9p) A body of mass m is suspended from a vertical spring with spring constant k . At equilibrium, the elastic potential energy of the spring has the expression:

- A) $\frac{(mg)^2}{k}$ B) $\frac{(mg)^2}{2k}$ C) mgk D) $\frac{mg^2}{k}$

7. (0.9p) The engine of a car with mass $m=800\text{ kg}$ develops the power $P=100\text{ kW}$ at a speed of $v=72\text{ km/h}$. Neglecting friction, the maximum acceleration that the car can have at that speed is:

- A) 6.25 m/s^2 B) 4.5 m/s^2 C) 2.5 m/s^2 D) 5 m/s^2

8. (0.9p) The braking force that must be applied to a body with mass $m=10\text{ t}$, moving at speed $v=72\text{ km/h}$, to stop it in $\Delta t=40\text{ s}$ is:

- A) 10 kN B) 14 kN C) 5 kN D) 7 kN

9. (0.9p) Two springs with elastic constants k_1 and k_2 , connected in series, support a body with mass m . The ratio of the elastic energies stored in the two springs, E_1/E_2 , is:

- A) k_1/k_2 B) $k_1 k_1 / (k_1 + k_2)^2$ C) k_2/k_1 D) k_1^2/k_2^2

10. (0.9p) A person with mass $m=70\text{ kg}$ is in an elevator, sitting on a scale. What mass will the scale indicate when the elevator is moving upwards with acceleration $a=g/5$?

- A) 68 kg B) 76 kg C) 100 kg D) 84 kg

11. (4p) A body with mass $m=80\text{ kg}$, located on an inclined plane of angle $\alpha=45^\circ$, slides freely towards its base, moving with friction ($\mu=0,1$). The body encounters a resistance force from the air $F_r=k v^2$, in which the constant has the value $k=0,8\text{ N/(m/s)}^2$. Determine the maximum speed reached by the body.

12. (5p) A body with mass $m=2\text{ kg}$ and kinetic energy $E_c=400\text{ J}$ is launched from point A to point B on a horizontal surface. Due to friction with the horizontal plane, the body reaches point B with its speed reduced by half and begins to climb an inclined plane BD with angle $\alpha=45^\circ$, stopping at point D. The coefficient of friction for sliding on the inclined plane is $\mu=0.25$, and the body's transition from the horizontal plane to the inclined plane is smooth, without changing the speed modulus. Find the maximum height to which the body climbs the inclined plane.

