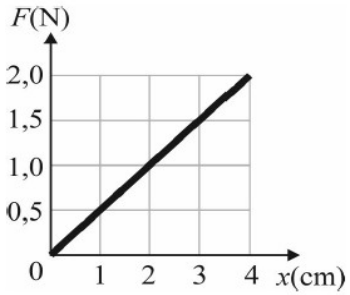
Mechanics Model Test Admission 2024

When necessary, consider the gravitational acceleration g = 10m/s^2.
Items 1-10 are multiple-choice with a single correct answer, and each is scored with 0.9 points (1 point awarded from start for this section).
Items 11 and 12 are scored with 4.5 points each (1 point awarded from start for this section)
Final score is calculated as: N=0.6N1+0.4N2, unde
N1=score for the first section (items 1-10) +1 point from start,
N2=score for the second section (items 11-12) +1 point from start .
Working time – two hours.

1. Taking into account the notations for the physical quantities and standard units of measurement from your physics textbooks, the measurement unit for the ratio F/S_0 is:

a) $kg \cdot m \cdot s^2$; b) $kg^{-1} \cdot m \cdot s^{-2}$; c) $kg \cdot m^{-1} \cdot s^{-2}$; d) $kg \cdot m^{-1} \cdot s^2$.

2. In the figure attached to the right, one can observe the plot of the deforming force *F* acting upon a spring against the spring elongation *x*. The mechanical work accomplished for elongating the spring by 4 cm is equal to:



a) 100 mJ; b) 80 mJ; c) 60 mJ; d) 40 mJ.

3. The mechanical work is a physical quantity:

a) function of state; b) function of process;
c) function independent of process; d) constant.

4. A body moves on a horizontal surface under the action of some forces whose resultant is zero. We may say that:

a) the movement of the body is uniformly accelerated b) the movement of the body is uniform c) the body stops d) the movement of the body is uniformly slowed

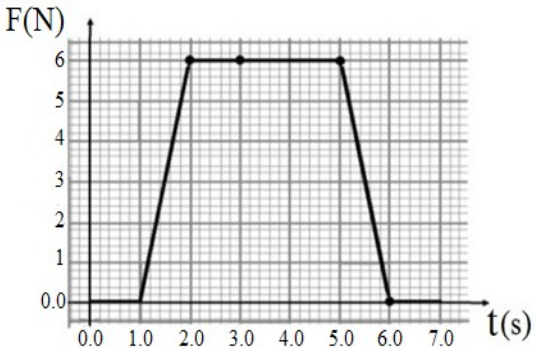
5. Considering the notations known for the physical quantities from your physics textbooks, the friction force acting on a body which descends freely on an inclined plane of angle α can be written as follows:

a) $F_f = \mu mg$; b) $F_f = \mu mg\cos\alpha$; c) $F_f = \mu mg\sin\alpha$; d) $F_f = \mu mgtg\alpha$.

6. As a physical quantity, the mechanical power is a

a) vector quantity measured in J; b) scalar quantity measured in W;
c) vector quantity measured in Ns; d) vector quantity measured in CP.

7. The plot in the figure below illustrates how the force applied to a rocket varies during launch.



According to the graph, the linear momentum given to the rocket by its engine has the value of:

a) p = 24 N·s; b) p = 36 N·s; c) p = 32 N·s; d) p = 0 N·s.

8. An athlete of mass $m_1 = 80\,kg$ runs with the speed $v_1 = 10\,m/s$. What is the speed that another athlete of mass $m_2 = 60\,kg$ should have such that both athletes have the same kinetic energy?

a) $\frac{\sqrt{3}}{20} m/s$; b) $7{,}5\,m/s$; c) $10\,m/s$; d) $\frac{20}{\sqrt{3}} m/s$.

9. An elastic thread has the elastic constant $k = 300\,N/m$. We cut and remove a third of the total length of the undistorted thread. The elastic constant of the remaining part of the thread is equal to:

a) 450 N/m; b. 600 N/m; c. 900 N/m; d. 400 N/m.

10. A student carried out an experiment in which he varied the mass attached on an elastic rubber rod, sitting in vertical position and measured its final length. The obtained data are shown in the table attached to the right.

Weight attached (N)	Length spring (m)
0,98	0,37
1,96	0,42

The student forgot to measure the initial length of the spring. The value of the initial length of the spring is:

a) $l_0 = 32cm$ b) $l_0 = 16cm$ c) $l_0 = 34cm$ d) $l_0 = 24cm$

11. Two bodies with masses $m_1 = 200\,g$ and $m_2 = 400\,g$ are placed on a horizontal surface and connected by means of a spring having the elastic constant k = 100 N/m in an uniform

gravitational field *g*. The friction coefficient between the two bodies and the horizontal plane is $\mu = 0.4$. Calculate:

a) the minimum horizontal force acting on the first body that brings the second body out of rest;

b) the elongation of the spring corresponding to the force calculated above.

12. Find the accelerations of the bodies of mass *m* and *m'* from the system sketched in the figure below, given the gravitational acceleration *g*. Assume there is no friction, the strings are massless and inextensible, the pulley has negligible mass, and the bodies are point masses.