

Physics Entrance Exam

Part I – Exercises, problems

- 1.) A 0.2 kg ball of negligible size is attached to the free end of a simple pendulum of length 0.8 m. The pendulum is deflected to a horizontal position and then released without pushing. (Let $g = 10 \frac{m}{s}$. Ignore the effects of air resistance. In the time instant in question, when the pendulum is vertical, the motion can be considered uniform circular motion.)
 - a) What is the speed of the ball in the vertical position of the pendulum?
 - b) Determine the centripetal acceleration of the ball in the vertical position of the pendulum!

- 2.) In a cylinder of cross section 1 dm^2 , closed at one end, a tight-fitting piston encloses an air column of length 7 dm . We press the piston inwards until the force we are exerting on the piston reaches 400 N . During the compression, the temperature of the gas does not change. The external air pressure is 10^5 Pa .
 - a) What pressure will we exert on the gas?
 - b) What will be the pressure of the gas then?
 - c) What will be the volume of the gas?

- 3.) A car travels at a constant speed of $80 \frac{km}{h}$ during the first half distance of its route. Its speed is $40 \frac{km}{h}$ and still constant on the other half distance of its route.
 - a) Find the average speed of the car regarding on the whole route!
 - b) What is the average speed if the car covers half time of its full running time at a velocity of $80 \frac{km}{h}$ and other half time of its full running time at a velocity of $40 \frac{km}{h}$?

- 4.) A spring is suspended at one end, and an object of mass 2 kg is hung on the other end. As a result, the spring stretches by 10 cm . ($g = 10 \frac{m}{s^2}$)
 - a) Find the spring constant of the spring!
 - b) What work is needed to stretch the spring further by 5 cm ?

- 5.) There is a switch in the circuit shown in the Figure 1. The resistances of the resistors are 10Ω each and the voltage across the battery is $U = 5 \text{ V}$. What is the power at each resistor if switch is
 - a) closed?
 - b) open?

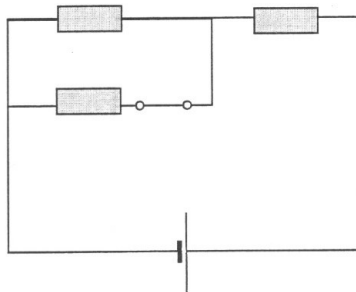


Figure 1. Figure to the problem 5.).

Part II – Multiple choice test.

- 1.) What is the correct equation?
- a) $13600 \frac{kg}{m^3} = 1360 \frac{kg}{dm^3}$.
 - b) $13600 \frac{kg}{m^3} = 13.6 \frac{g}{cm^3}$.
 - c) $2.7 \frac{g}{cm^3} = 27 \frac{kg}{m^3}$.
 - d) $1 \frac{g}{cm^3} = 1000 \frac{kg}{dm^3}$.
- 2.) There are two light rays. The color of one is blue; the color of the other is red. Which has a longer wavelength?
- a) The blue one.
 - b) The red one.
 - c) This question cannot be decided from the color.
- 3.) The resistance of the bulb of a car's parking light is 37.5Ω . The voltage of the car battery is $12V$. What current flows through the bulb when it is on?
- a) $0.32 A$
 - b) $3.125 A$
 - c) $4.5 A$
- 4.) Two identical resistors are connected in series to a certain voltage. Then they are connected in parallel to the same voltage. In which case will the total power dissipated by the two resistors be larger?
- a) When they are connected in series.
 - b) When they are connected in parallel.
 - c) The same power will be dissipated in each case.
- 5.) If a $50 N$ force is exerted on a spring, then its elongation is $10 cm$. What is the elongation of the spring if it is pulled apart by two forces, both a $100 N$ at its two ends, one of them points to the right, the other to the left.
- a) $10 cm$.
 - b) $20 cm$.
 - c) $40 cm$.
- 6.) How many neutrons are there in a nucleus of the ${}_{92}^{236}U$ isotope?
- a) 144.
 - b) 236.
 - c) 328.

- 7.) Which radiation is electrically neutral?
- alpha-radiation.
 - beta-radiation.
 - gamma-radiation.
- 8.) Two railway carriages are traveling in the same direction. They collide, couple together and move on together. Which statement is true about their combined kinetic energy?
- The total kinetic energy of the coupled carriages is equal to the sum of the kinetic energies they had before the collision.
 - The total kinetic energy of the coupled carriages is greater than the sum of the kinetic energies they had before the collision.
 - The total kinetic energy of the coupled carriages is smaller than the sum of the kinetic energies they had before the collision.
- 9.) You can see three pots in the Figure 2. Bottom surface areas of all three pots are the same. What is the correct sentence for this situation?
- Pressures at the bottom surfaces of all three pots are equal to each other.
 - Highest pressure value can be measured at the bottom of pot 'a'.
 - Lowest pressure value can be measured at the bottom of pot 'c'.

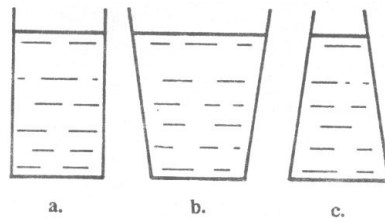


Figure 2. Figure to the problem 9.).

- 10.) You help your friends to move from a studio to another ones in a same building. Two cases are given:
- You take and move an object of mass 5 kg from the first floor to the third floor.
 - You take and move an object of mass 10 kg from the first floor to the second floor.
- In which case is the mechanical work done by you greater?
- In case of (i).
 - The mechanical works done by you are the same in both cases.
 - In case of (ii).