EXERCISES
GRAVITATION AND ELASTICITY

These are the indicators of the lesson that you should master:

- Analyze the relation between gravity force, mass of the matter and the distance between the matter
- Calculate the resultant of gravity forces that exerted on a particle in a certain system
- *Determine magnitude of gravity acceleration on earth surface by using concept of gravity field*
- Compare the magnitude of gravity acceleration with the magnitude gravity field at different position
- Analyze planets motion in the solar system by using Keppler's first Law
- Explain the implication of Keppler's second Law due to orbital speed of the planet
- Calculate revolution period of a planet by applying Keppler's third Law
- Describe the characteristic of the force that works at an elastic material based on the result of the experiment (graphicaly)
- Determine modulus of elasticity and force constant of a material
- Compare the force constant based on data that gathered from the experiment
- Analyze series and parallel arrangement of springs
- Describe the characteristic of spring oscillation
- Explain the relation between oscillation period and mass of the pendulum based on observation result
- Analyze the force that act on the system, acceleration and the velocity of the oscillation
- Determine position of a point at a particular time of a simple harmonic oscillation
- *Describe the characteristic of damped harmonic oscillation*
- Determine maximum weight that can be loaded to a vehicle by considering the characteristic of its shock breaker

If you want to be success in the next bloc test, you have to master the concept that are required by those indicators.

These are the exercises that you have to do, to check your understanding to the concepts of gravitation and elasticity. The problems that are given in this exercise sheet are based on the indicators above:

1. Pak boy puts a particle which has mass of m at the distance of 2 meters from other particle which has mass of M. Then he puts the second particle which has mass of $2m$ at distance of 4 meters from particle M. Find the ratio of the forces that acts on mass m and $2m$ as they interact with particle M!

2. Two particles are separated at the distance of 2m. The mass of first particle is 2 kg and the mass of the second particle is 4 kg. If the third particle is put in the middle of the line that is connecting first particle and second particle, what is the resultant of forces that act on the third particle!
3. Where on earth should a person jump, so that he can reach a maximum height? (hint : consider that the earth is not a perfect sphere)
4. How can Keppler's first law explain the phenomena that the distance of planets when they are orbiting to the sun is vary?
5. What is the implication of Keppler's second law to the speed of the planets when they are orbiting the sun?
6. If the distance between a planet and the sun is 8 times the distance between the earth and the sun, how many year would it take to orbit the sun? The period of earth's revolution is 1 year
7. A wire has diameter of 0.125 cm and length of 80 cm. If the wire is given a load of 100N, its length increases for 0.5 mm. Find:
    a. Stress of the wire
    b. Strain of the wire
    c. Modulus of elasticity of the wire
    d. Force constant of the wire
8. To increase the length of a spring we have to pull the spring with a certain force. Draw the graphic of the force that is needed to stretch the spring as a function of the increment of the spring!
9. Moce has two identical springs. If the constant of each spring is k, compare the constant of the system if the springs are arranged in series and if the springs are arranged in parallel!
10. From the problem number 9, find oscillation frequencies of each system, if both systems are having m kg of mass hang on it!
11. Position of a point in a simple harmonic motion is given by :

    $Y = 20 \sin (2\pi t + \frac{1}{2} \pi)$

    where y in cm and t in second. Determine :

    a. position of the point at $t = \frac{1}{4}$ s

b. velocity of the point at t = 2 s
c. maximum acceleration of the point

12. The constant of the spring in a shock breaker is 10 000 N/m. The shock breaker will still work properly if the decrement of the spring is less than 10 cm. What is the maximum weight that can be loaded on the shock breaker? What is its frequency if it is loaded with the maximum weight?