YOUNG SPACE RESEARCHERS' TOURNAMENT

Questions for the Collective Competition by Correspondence

1. "Think for yourselves".

   Make in your school lab an apparatus demonstrating the phenomenon of weightlessness.

2. "Astronaut".

   What is the maximum distance an astronaut can count on travelling
   a) on contemporary level of technological development
   b) in the remote future, when practically all technological complications are overcome?

3. "The clock".

   You've visited a certain planet and hope to return to it in 10 thousand years or even in a million years. What kind of clock would you leave behind to measure exactly the time of your absence from the planet?

4. "Correcting the orbit".

   An artificial satellite with the mass M is moving along a circular orbit at the altitude of H (about 200 kilometers) above the surface of the Earth. In what way will the parameters of its orbit change if the engines impart to it the additional momentum
   p ($p \ll p$)

   a) momentum oriented along the trajectory of the flight
   b) perpendicularly to the trajectory, in the same plane with the orbit
   c) perpendicularly to the plane of the orbit ?

5. "Energetic spends for correction".

   What is the minimum amount of energy to be spend by the engines of an artificial satellite in order to turn the plane of the trajectory by the angle   ?

6. "Linked satellites".

   It is necessary to place two satellites having masses   and   along the same line with the center of the Earth. What is the most economical method of holding the satellites in this position:
   a) distance between satellites 100 meters
   b) distance   is 10 kilometers?

7. "Angling from a satellite".

Is it possible to put a zond on a metal wire from a stationary satellite down to the Earth surface or at least to the dense layers of the atmosphere?

8. "Anti-meteorite defence".

Work out a system of defending a spacecraft against micro-meteorites and medium-sized meteorites. If your system failed, how much time does an astronaut have for detecting and mending a hole 1 millimeter diameter made by a meteorite in the hull of the spacecraft?

9. "Black Hole".

How can you find out that your spacecraft is approaching a Black Hole and how can you escape such an unpleasant encounter?

10. " A comet".

Imagine that according to the astronomers, an ice comet with a mass of   kilograms is in some years to collide with the Earth. Think out a plan of preventing the disaster.

11. "Gravitational acceleration".

Motivate the method of using gravitational fields of planets for accelerating a spacecraft. In what year and on what particular date would you suggest starting the flight of an unmanned spacecraft toward boundaries of the Solar System, if we choose to use Venus as an accelerator? Launching velocity of the spacecraft is 15 km/s.

12. "Interstellar medium".

How can one define the state of the matter in the interstellar space – vacuum or gas? Can acoustic waves spread in the interstellar medium?

13. "Asteroid".

It is known that small-sized asteroids often have irregular shapes, while large planets are always spheric. Estimate the maximum size of an asteroid existing as a cube. How much time will it take a small planet (approximately the same size as a Moon), split into two, to become two spheric planets?

14. "Earth and Mars".

An astronaut observes the Earth from the surface of Mars. What is the absolute stellar magnitude of the Earth and when is it at its maximum?

15. "The galaxy".

An astronomer studies the radiation spectrum of a spiral galaxy which presents to him its lateral view. The slit of the spectrographic device is parallel to the galaxy plane. It turned out that the spectral lines are slanting straigth lines. How can this spectrum help estimate the mass of the galaxy? How is the mass spread within the galaxy?

16. "The Lunar atmosphere".

Imagine that you could make the atmosphere in the Moon similar to that of the Earth. Describe its parameters and properties. How quickly will it disappear and how can one converse it?

17. "Socker on the Moon".

The Moon is likely to become a favorite recreation place of people from the Earth. Unfortunately, socker fans will be disappointed. Think of an active game for vacationeers on the Moon that would be no less entertaining as the socker.

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