

TSOKOS READING ACTIVITY

Section 10-2

1. IB Assessment Statements for Topic 10.2, Gravitational Field, Potential and Energy
2. Essential Idea: Similar approaches can be taken in analysing electrical and gravitational potential problems.
3. Nature Of Science: Communication of scientific explanations: The ability to apply field theory to the unobservable (charges) and the massively scaled (motion of satellites) required scientists to develop new ways to investigate, analyse and report findings to a general public used to scientific discoveries based on tangible and discernible evidence.
4. Understandings:
 - a. Potential and potential energy
 - b. Potential gradient
 - c. Potential difference
 - d. Escape speed
 - e. Orbital motion, orbital speed and orbital energy
 - f. Forces and inverse-square law behavior
5. Applications And Skills:
 - a. Determining the potential energy of a point mass and the potential energy of a point charge
 - b. Solving problems involving potential energy
 - c. Determining the potential inside a charged sphere
 - d. Solving problems involving the speed required for an object to go into orbit around a planet and for an object to escape the gravitational field of a planet
 - e. Solving problems involving orbital energy of charged particles in circular orbital motion and masses in circular orbital motion
 - f. Solving problems involving forces on charges and masses in radial and uniform fields
6. Guidance:
 - a. Orbital motion of a satellite around a planet is restricted to a consideration of circular orbits (links to 6.1 and 6.2)
 - b. Both uniform and radial fields need to be considered
 - c. Students should recognize that lines of force can be two-dimensional representations of three-dimensional fields
 - d. Students should assume that the electric field everywhere between parallel plates is uniform with edge effects occurring beyond the limits of the plates.

- e. Give the long and 2 short equations of the total energy of a satellite. _____

- f. What are the possible paths for an object launched from the surface of the earth with some speed?
1) _____
2) _____
3) _____
4) _____
- g. Give an equation for a satellite's velocity given a distance r from the body it is orbiting. _____

- h. If the mass of a satellite is doubled, what is the change in its orbiting speed? _____

- i. Explain why a satellite moves to a lower orbit when it encounters frictional forces due to the atmosphere. _____

- j. Explain why (and how) this move to a lower orbit will cause the satellite to increase its velocity rather than decrease. _____

- k. Define escape velocity, V_{esc} . _____
- l. Give the equation for escape velocity. _____
- m. Is escape velocity dependent on the mass that is escaping? _____
- n. For an escape from planet earth (sounds like a B-movie title) where the acceleration due to gravity is _____, the escape velocity can be rewritten as _____
- o. What is the escape velocity in m/s required from just the earth's gravitational pull? _____
- p. In reality, what other factors are involved with escape from the earth? _____

- q. Nothing that we know of can go faster than the speed of light. What is it called when a star is so massive (large R) that the required escape velocity is faster than the speed of light? _____

- r. What is the name for a radius that requires an escape velocity is faster than the speed of light? _____

- s. What is the meaning of the term 'weightless'? _____

- t. Explain the geometric significance of the inverse square law as it applies to gravitational and electrical fields. _____

- u. Name another point of significance of the inverse square law as it applies to gravitational and electrical fields. _____

12. Answers may be typed or neatly printed. Drawings may be freehand, but try to make use of the 'Shapes' or 'Insert Clipart' functions of MS Word. If you submit this assignment electronically, the filename must be in the following format, "LastnameFirstinitialPerXReadActX-X".

