BITSAT 2023 May 24 (Shift 2) Question Paper with Answers (Memory Based)

Question 1. Why did the time period of rotation of Earth decrease by microseconds after the Japan 2011 earthquake?

A. The oceanic floor and land disturbances caused the effect of rate of rotation of Earth.
B. Redistribution of mass caused MOI to increase.
C. Redistribution of mass caused MOI to decrease.
D. The kinetic energy of Earth increased due to earthquakes.

Answer: Redistribution of mass caused MOI to increase.

Solution: The time period of rotation of Earth did not decrease after the Japan 2011 earthquake. In fact, the earthquake caused a slight increase in the Earth's rotation period, resulting in a shortening of the day.

During large-scale earthquakes, the distribution of mass on Earth can change. The Japan 2011 earthquake, also known as the Great East Japan Earthquake, was a massive undersea earthquake that occurred off the northeastern coast of Japan on March 11, 2011. This earthquake had a significant impact on the Earth's rotation due to the redistribution of mass caused by the shifting of tectonic plates.

The earthquake caused the Pacific tectonic plate to move and resulted in a redistribution of mass, primarily by shifting a significant amount of Earth's crust from the ocean floor to land. This shift of mass closer to the Earth's axis of rotation caused a slight increase in the planet's moment of inertia.

To be more precise, the earthquake's effect on Earth's rotation was estimated to have shortened the day by approximately 1.8 microseconds (1.8 millionths of a second) by redistributing the Earth's mass closer to the axis. This change is relatively small and would not be perceptible to human experience.

Question 2. The potential energy of a body is given by U(x) and it has mechanical energy is E. Then its potential energy when its velocity is zero is given by?

Answer: Potential energy of the body when its velocity is zero is equal to its total mechanical energy (E).

Solution: The potential energy of a body is given by U(x), and its total mechanical energy is E. When the body's velocity is zero, it means it has come to rest, and its kinetic energy is zero. In this scenario, we can determine the potential energy.

The total mechanical energy (E) of the body is the sum of its kinetic energy (K) and potential energy (U). Since the body is at rest, its kinetic energy is zero, so we can write:

$E = K + U$

Since $K = 0$, the equation simplifies to:

$E = 0 + U$

Therefore, the potential energy of the body when its velocity is zero is equal to its total mechanical

energy (E).

Question 3. Gibbs free energy formula is.

Answer: G = H – TS or more completely as G = U + PV – TS

Solution: Gibbs free energy is equal to the enthalpy of the system minus the product of the temperature and entropy. The equation is given as:

G = H – TS

Where,

G = Gibbs free energy
H = enthalpy
T = temperature
S = entropy

OR

or more completely as:
G = U + PV – TS

Where,
U = internal energy (SI unit: joule)
P = pressure (SI unit: pascal)
V = volume (SI unit: m3)
T = temperature (SI unit: kelvin)
S = entropy (SI unit: joule/kelvin)

Question 4. Ratio of time periods of electrons in 1st and 2nd orbits of Hydrogen is?

Answer: 1:8

Solution: The time period of an electron is given by,

T = n3h3/(4π2mZ2e4)

For first orbit, n = 1

T1 = 13h3/(4π2mZ2e4)

For second orbit, n = 2

T2 = 23h3/(4π2mZ2e4)

Therefore, we have T1/T2 = 1:8

Question 5. A planet of radius 8000 km transforms into a star of radius 8 km. If the initial time period is 15h then what is the new time period?

Question 6. 1, 0, 0, 3, 20, what is the next number in the sequence?

Question 7. A block is pushed up a frictionless incline with velocity v. It comes down with which velocity?

Question 8. dy/dx = sinx/sin(x + 2). Find y in terms of x.

Question 9. Find the sum of all 4 digit numbers using digits 1,2,3,4,5,6 with no repetition.

Question 10. ∫(tan-1x.etan-1x)/1 + x2.dx

Question 11. Find the focus of the ellipse (x - 3)2/25 + (y-7)2/16 = 1.

Question 12. Equation of tangent to the circle is given by x2 + y2 - 12x + 16y + 19 = 0 which is parallel to the straight line 4x + 3y = 5.

Question 13. If the line y = mx + 1 is tangent to parabola y2 = 4x, then find the value of m.

Question 14. A compound X gives 6.6 g CO2 and 1.35 g of H2O on complete combustion. Find the formula of X.