BITSAT 2023 May 24 Shift 1 Question Paper With Answers and Solutions (Memory-based)

Question 1. If an object of mass m is given a velocity equal to twice the escape velocity of Earth then the velocity of the object at the point where Earth shows no Gravitational force strength would be at?

Answer: At an infinite distance from Earth.

Solution: The velocity of an object at the point where Earth's gravitational force becomes negligible (far away from Earth) would be zero.

The escape velocity of Earth is the minimum velocity an object needs to escape the gravitational pull of Earth and never return. If an object is given a velocity equal to twice the escape velocity, it means the object has more than enough energy to escape Earth's gravitational field.

As the object moves farther away from Earth, the gravitational force between Earth and the object decreases. At a certain point, the gravitational force becomes negligible compared to other forces acting on the object. This point is often considered to be at an infinite distance from Earth.

At this point, the object's velocity would become zero because there is no gravitational force acting on it. In other words, the object would be moving away from Earth at a decreasing velocity until it eventually comes to rest (velocity equals zero) at an infinite distance from Earth.

Question 2. Photochemical smog pollutants cannot be reduced by?

Solution: Photochemical smog pollutants cannot be reduced by physical methods alone. Physical methods involve removing or filtering pollutants

through physical processes such as filtration, condensation, or absorption. However, photochemical smog is primarily composed of pollutants that result from chemical reactions involving sunlight, nitrogen oxides (NOx), volatile organic compounds (VOCs), and other reactive compounds.

To effectively reduce photochemical smog pollutants, it requires chemical or biological methods that can break down or transform the reactive compounds into less harmful substances. Some of the methods used to mitigate photochemical smog include:

- Catalytic converters: These are used in automobiles to facilitate the conversion of harmful pollutants such as nitrogen oxides and volatile organic compounds into less harmful substances through catalytic reactions.
- Emission controls: Implementing stricter regulations and emission standards on industries and vehicles to reduce the release of pollutants into the atmosphere.
- Alternative transportation and energy sources: Encouraging the use of cleaner energy sources, such as renewable energy, and promoting the use of public transportation, walking, or cycling instead of relying heavily on individual vehicle transportation.
- Volatile organic compound (VOC) reduction strategies: Implementing measures to reduce the emission of VOCs from industrial processes, consumer products, and solvents, including the use of low-VOC products and improved industrial practices.
- Smog alerts and public awareness: Informing the public about high pollution levels and providing recommendations to reduce activities that contribute to smog formation, such as limiting vehicle use, reducing outdoor activities during peak pollution times, and promoting energy conservation.

It is important to note that while physical methods may not directly reduce photochemical smog pollutants, they can play a role in reducing other types of pollutants that contribute to overall air pollution, such as particulate matter (PM) and certain gases.

Question 3. The statement “velocity and acceleration always act through the same straight line, either in the same or opposite direction” applies for which dimensional motions?

Answer: In one dimensional motion.

Solution: The statement "velocity and acceleration always act through the same straight line, either in the same or opposite direction" applies to one-dimensional motions.

In one-dimensional motion, an object moves along a straight line, and its position, velocity, and acceleration can be described using a single coordinate or axis. The statement implies that in one-dimensional motion, the velocity and acceleration vectors are parallel or antiparallel to each other, meaning they either point in the same direction or in opposite directions along the straight line of motion.

However, in two or three-dimensional motions, such as motion in a plane or in space, the velocity and acceleration vectors can have components in different directions. In these cases, the velocity and acceleration vectors may not always align or have a simple relationship with each other along a single straight line. The relationship between velocity and acceleration in multi-dimensional motion can be more complex and dependent on the specific motion and forces involved.

Question 4. Two inductors each of 50mH are connected in parallel, what is the equivalent inductance?

Answer: 25mh

Solution: When inductors are connected in parallel, the equivalent inductance (L_eq) can be calculated using the formula:

$1/L_{eq} = 1/L1 + 1/L2 + 1/L3 + ...$

In this case, you have two inductors each with an inductance of 50 mH. Plugging in the values into the formula:

1/L_eq = 1/50mH + 1/50mH

To add the fractions, you need a common denominator:

1/L_eq = (1/50mH + 1/50mH) / (1mH)

Simplifying the numerator:

1/L_eq = (2/50mH) / (1mH)

1/L_eq = 2/50

Inverting both sides:

L_eq = 50/2

L_eq = 25 mH

Therefore, the equivalent inductance of two 50 mH inductors connected in parallel is 25 mH.

Question 5. Conversation of linear momentum is a necessary condition for which Kepler's laws?

Answer: For Kepler’s Second Law, also known as the Law of Equal Areas.

Solution: The conservation of linear momentum is a necessary condition for Kepler's Second Law, also known as the Law of Equal Areas.

Kepler's Second Law states that the line segment connecting a planet to the Sun sweeps out equal areas in equal time intervals. This means that as a planet orbits around the Sun, it covers equal areas in its orbital path over equal time intervals.

The conservation of linear momentum is necessary to understand this law because the angular momentum of a planet remains constant as it moves

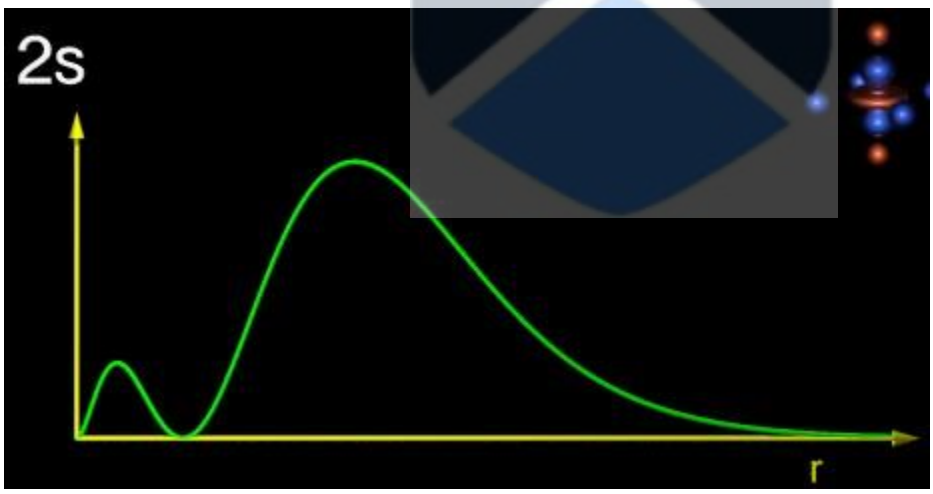
in its elliptical orbit around the Sun. Angular momentum is related to linear momentum, and when linear momentum is conserved, angular momentum is also conserved.

In the absence of external forces, conservation of linear momentum implies that the planet's velocity will change as it moves along its elliptical orbit. As the planet approaches the Sun, it speeds up, and as it moves away from the Sun, it slows down. This change in velocity ensures that the area swept by the line segment connecting the planet to the Sun remains constant over equal time intervals, fulfilling Kepler's Second Law.

Therefore, the conservation of linear momentum is a necessary condition for Kepler's Second Law, which describes the equal areas law.

Question 6. The Radial Probability curve for 2s orbital.

Answer:



Question 7. How many elements are there in period 4 of the periodic table?

Answer: 18 elements.

Solution: The period in the periodic table:

1) The elements in the horizontal rows of a periodic table represent periods.

2) The 4th-period elements are the elements in the 4th row of the periodic table.

The number of elements in a period can be determined as:

Let 'p' be the period number, and

- If p is even, the number of elements is: $(P + 2)^2/2$
- If p is odd, the number of elements is: $(P + 1)^2/2$

Since period number is 4, it is even.

Therefore, number of elements in period 4 will be

$(4+2)^2/2 = 36/2 = 18$

Hence, there are 18 elements in period 4 of the periodic table.

Question 8. If a block is pushed upwards on an inclined plane with velocity v and then it comes back to the initial position, then it's velocity is

A. equal to v
B. more than v
C. less than v
D. more or less than v depending on the angle of the inclined plane.

Question 9. If gamma (C_p/C_v) of a gas is 1.5, then in an adiabatic process what would be the relation between T and V?

Question 10. An acid has pH = 4 and pK_a = 5, what would be the initial

concentration of the acid.

Question 11. What would be the reaction between B and $LiAlH_4$

Question 12. If points A(x_1, y_1, z_1), B(x_2, y_2, z_2), C(x_3, y_3, z_3) are collinear then in which ratio does B divide AC?

Question 13. Odd one out: red, yellow, green, pink.

Question 14. Odd one out: saturday, monday, tuesday, thursday