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Question: 1

In space, small particles of matter can join together to form larger particles. Those larger particles have more mass and can then attract even more particles to themselves to grow even larger. Eventually, they may form an asteroid, comet, planet, or star.
Which force allows the particles to attract more and more particles as their mass increases?

A. Gravitational
B. Electrical
C. Frictional
D. Magnetic

Answer: A

Explanation:
In space, particles attract each other due to the force of gravity. This attraction increases as the particles ' mass increases, leading to the accumulation of more matter.
Gravity is a fundamental force that causes objects with mass to be attracted to one another. As particles gather and grow in mass, their gravitational pull becomes stronger, allowing them to attract even more particles.
This process can lead to the formation of larger celestial bodies such as asteroids, comets, planets, or stars. References:
Integrated Physical Sciences resources on gravitational forces and celestial body formation.

Question: 2

The Space Shuttle ' s engines used the reaction between hydrogen and oxygen to generate thrust. In this reaction, hydrogen and oxygen react to form water.
How is mass affected in this reaction, according to the law of conservation of matter?

A. The mass of oxygen must equal the total mass of water.
B. The mass of hydrogen must equal the total mass of water.
C. The mass of water must equal the total mass of hydrogen and oxygen.
D. The mass of hydrogen must equal the total mass of oxygen.

Answer: C

Explanation:
In the reaction between hydrogen and oxygen to form water, the law of conservation of matter dictates that the total mass of the reactants (hydrogen and oxygen) must equal the total mass of the product (water). This is because mass cannot be created or destroyed in a chemical reaction. Thus, the combined

mass of hydrogen and oxygen before the reaction will be equal to the mass of water produced after the reaction.
References:
Integrated Physical Sciences materials on chemical reactions and mass conservation.
Standard principles in chemistry related to the law of conservation of mass.

Question: 3

A system of underground pipes heated by Earth s hot interior creates steam from water, which generates heat for a building.
Which type of energy source is harnessed in this scenario?

A. Hydropower
B. Geothermal
C. Biomass
D. Tidal power

Answer: B

Explanation:
The scenario describes a geothermal energy system. Geothermal energy harnesses the heat from the Earth ' s interior to generate steam, which can then be used to produce electricity or provide direct heating. In this case, underground pipes circulate water that is heated by the Earth ' s internal heat, turning it into steam to generate heat for a building. References :
U.S. Department of Energy (DOE) Geothermal Technologies Office
" Geothermal Energy: Clean Power from the Earth’s Heat " - National Renewable Energy Laboratory (NREL)

Question: 4

The island of Iceland is located at a divergent plate boundary. At this boundary, the North American plate and the Eurasian plate are moving apart.
What is expected about natural hazards in Iceland, based on its tectonic setting?

A. There is high risk of volcanism and low risk of large earthquakes.
B. There is high risk of large earthquakes and low risk of volcanism.
C. There is high risk of both volcanism and earthquakes.
D. There is low risk of both volcanism and earthquakes.

Answer: C

Explanation:
Iceland is located on the Mid-Atlantic Ridge, where the North American and Eurasian tectonic plates are diverging. This divergent plate boundary is characterized by the formation of new crust as magma rises from below the Earth ' s surface, leading to frequent volcanic activity. Additionally, as the plates move

apart, the stress can cause significant seismic activity, resulting in earthquakes. Therefore, Iceland experiences both high volcanic and earthquake activity due to its tectonic setting.
References:
Integrated Physical Sciences documents on plate tectonics and natural hazards.
Geological studies on the Mid-Atlantic Ridge and Iceland ' s tectonic activity.

Question: 5

In 2011, scientists reported on an experiment in which neutrinos appeared to travel faster than light. This result was remarkable because it violates Einstein's theory of special relativity, which has been a cornerstone of our understanding of physics since 1905.
What is the appropriate scientific approach for dealing with this contradiction?

A. Check the experimental setup and try to replicate the results
B. Change the new data to show speeds lower than the speed of light
C. Abandon Einstein's theory because it has been proven invalid
D. Ignore the new data because it contradicts Einstein's idea

Answer: A

Explanation:
*Understand the claim:** In 2011, scientists observed neutrinos that appeared to travel faster than light, which would contradict Einstein's theory of special relativity. - **Scientific principles:** Einstein's theory of special relativity has been extensively validated and is a cornerstone of modern physics. Any claim that contradicts it requires thorough investigation. - **Appropriate response:** The scientific method dictates that extraordinary claims require extraordinary evidence. The first step should be to check the experimental setup for errors or anomalies that could explain the unexpected results. - **Replication:** Independent replication of the experiment is essential to confirm or refute the findings. If other scientists can replicate the results under controlled conditions, the claim gains credibility. Otherwise, the initial results are likely due to experimental errors. - **Conclusion:** The best approach is to critically evaluate the experiment and attempt to replicate the results, ensuring the integrity of the scientific process. **References:** Peer-reviewed journals on particle physics, reports from CERN, and documentation on the principles of the scientific method.

Question: 6

Which question would be appropriate for an observational study?

A. How does the mass of a toy car affect how fast it rolls down a track?
B. What is the brightest star that can be seen from Earth?
C. Which type of glass best resists scratching?
D. Which type of rock dissolves fastest when exposed to acid rain?

Answer: B

Explanation:

An observational study involves collecting data without manipulating any variables. The question " What is the brightest star that can be seen from Earth? " fits this criteria as it involves observing and recording data about stars without any experimental intervention. Other options involve controlled experiments where variables are manipulated. References:
Integrated Physical Sciences, Chapter 2: Methods of Scientific Investigation

Question: 7

Which type of wave can travel through a vacuum?

A. Radio waves
B. Water waves
C. Seismic waves
D. Sound waves

Answer: A

Explanation:
Wave propagation: Waves can travel through different mediums. Some waves, like sound and water waves, require a medium to propagate.
Vacuum travel: Electromagnetic waves, including radio waves, can travel through a vacuum. This is because they do not require a medium; they propagate through the oscillation of electric and magnetic fields.
Conclusion: The type of wave that can travel through a vacuum is a radio wave.
References: Integrated Physical Sciences materials on wave propagation, properties of electromagnetic waves, differences between mechanical and electromagnetic waves.

Question: 8

Why do comets develop tails when they are near the Sun?

A. The evaporation of ice and the release of dust particles
B. The increasing rate of debris impacts as the comet approaches the Sun
C. The combustion of flammable compounds in its atmosphere
D. The increasing velocity as the comet approaches the Sun

Answer: A

Explanation:
As comets approach the Sun, the increased solar radiation causes the ice within the comet to evaporate (a process called sublimation), releasing gas and dust particles. This creates a visible atmosphere called a coma, and the solar wind then blows this material away from the comet, forming a tail. The tail always points away from the Sun due to the force of the solar wind. References :
NASA’s Comet Exploration Missions
" Cometary Physics " - European Space Agency Publications

Question: 9

In which scenario does gravity cause the change in the object ' s motion?

A. A truck coming to a stop after applying the brakes
B. A skydiver accelerating towards the ground after jumping from a plane
C. A book sliding across a table after being pushed by someone
D. A speed skater accelerating across the ice after the starting gun

Answer: B

Explanation:
Gravity is the force that accelerates a skydiver towards the ground after they jump from a plane. In this scenario, gravity causes a significant change in the motion of the skydiver, pulling them downward and increasing their velocity until air resistance balances the force of gravity. References:
Integrated Physical Sciences, Chapter 3: Forces and Motion

Question: 10

Commercial airline pilots seek out stable atmospheric conditions to ensure a smooth flight.
Which layers of the atmosphere are of most interest to airline pilots?
Choose 2 answers.

A. Mesosphere
B. Stratosphere
C. Troposphere
D. Thermosphere

Answer: B, C

Explanation:
Commercial airline pilots primarily fly in the lower stratosphere and upper troposphere to avoid turbulence and ensure smooth flight conditions.
The troposphere is where weather phenomena and turbulence are common, so pilots seek stable conditions typically found at the boundary with the stratosphere.
The stratosphere offers stable atmospheric conditions, ideal for cruising altitudes. References:
Integrated Physical Sciences materials on atmospheric layers and aviation.

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