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PHY303
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1. What is the primary reason why scientists accept the idea that the speed of light is the same for everyone?

because it makes sense when you think about it as Einstein did

--->> because it has been verified by many observations and experiments

because no one has come up with a better idea about the speed of light

because the theory is just so darn cool, it can't be wrong

2. Suppose you measure the density (mass per volume) of an object moving by you at very high speed. How will its density compare to the density it would have at rest in your reference frame?

Its density would be lower.

--->> Its density would be higher.

Its density would be the same.

There is no way to know, because relativity doesn't tell us anything about density.

3. Two twin sisters, Gwen and Jackie, are both 20 years old in the year 2020. Jackie takes off on a round-trip to Vega, 25 light-years away. She travels at an average speed very close to the speed of lightÃ¢â‚¬â€say, 0.9999c. According to Gwen back on Earth, about how long does it take Jackie to reach Vega?

about a month

about 10 years

--->> about 25 years

about 100 years

4. A sprinter named Ben has challenged a beam of light to a race in the 100-meter dash. The race is held in a stadium full of spectators. At the start signal, a laser beam is turned on at the start line, pointed down the track. At the same instant, Ben bursts out of the starting blocks at 99% of the speed of light (0.99c). According to the spectators watching in the stands, what happens? (Assume they could somehow watch a slow-motion replay to see what occurred.)

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The light beam instantly finishes the race, before Ben even has a chance to start.

The light beam wins the race by a large margin because it is going faster than him by the full speed of light.

Ben beats the light beam to the finish line, becoming a hero.

5. Which of the following is not true of the special theory of relativity?

The special theory does not apply to situations that involve substantial acceleration or gravity; for that, you need the general theory of relativity.

For low speeds, the theory predicts effects that are so small that they cannot be noticed without extremely precise, high-tech measurement.

--->> The theory is valid only at speeds close to the speed of light.

The theory tells us that there is no such thing as absolute time or space, because measurements of time and space depend on your reference frame.

6. Suppose your normal resting heart rate is 60 beats per minute. Now, suppose you board a spaceship that travels away from Earth at 90% of the speed of light. While on the ship, you measure your heart rate. What will it be?

It will be 46 beats per minute.

It will be 74 beats per minute.

--->> It will still be 60 beats per minute.

It will be 12 beats per minute.

7. Bob is in a spaceship going by you at 90% of the speed of light, but in an upright standing position. Bob measures his mass to be 50 kg, his height to be 2.0 meters, and his waist size to be 80 cm. What would you say about his measurements?

--->> His mass is more than 50 kg, his height is still 2.0 meters, and his waist size is less than 80 cm.

His mass is more than 50 kg, his height is less than 2.0 meters, and his waist size is less than 80 cm.

His mass is less than 50 kg, his height is more 2.0 meters, and his waist size is less than 80 cm.

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8. Why do the predicted consequences of the special theory of relativity seem so strange to most of us?

because they are self-contradictory, making it impossible to make any sense of them

--->> because they are obvious only at speeds that we never experience in our daily lives

because they contradict the well-tested ideas of Newton's laws of motion

because they affect only subatomic particles and not big things like people

9. In what way do observations of binary star systems support the special theory of relativity?

Stars in binary systems often orbit at speeds close to the speed of light, allowing us to check whether time dilation really occurs.

Stars in binary systems are moving, so we can compare their moving masses to their rest masses.

--->> The fact that the stars appear distinct supports the idea that the speed of light is unaffected by the motion of the stars.

Binary systems have two stars, and therefore give us twice the opportunity to test the theory than single star systems.

10. What do we mean by length contraction in relativity?

It is the idea that if you measure the size of an object moving relative to you, you will find that it is shorter in every direction than it would be at rest. That is, length, width, and height are all shorter for an object when it is moving by you.

It is the idea that moving objects look smaller than nonmoving objects, but their sizes have not really changed.

--->> It is the idea that if you measure the size of an object moving relative to you, you will find that in the direction of motion it is shorter than it would be at rest, while its size in other directions is unchanged.

It is the idea that if you travel very fast, you'll notice yourself getting shorter.

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