

On your visitation day, your mum came with her sister to come and see your new school. In your discussions, you started showing her your results and she noticed your performance in science subjects especially physics and she wanted to know more about what physics is all about since during her time of study, it was considered to be a hard subject.

As a physics student, help answer your auntie the questions below to help her understand the subject well.

1. Define linear motion and provide an example from daily life.
2. Distinguish between vectors and scalars giving examples of each.
3. Explain why a piece of stone and a piece of chalk when released at the same time from a height from the ground both will fall at the same rate. And what is responsible for their falling include its unit of measurement.
4. Your auntie throws a stone at a goat in her farm with an initial velocity of 20 ms^{-1} at an angle of 30° above the horizontal. Calculate the horizontal distance the stone covers. Assume $g = 9.8 \text{ ms}^{-2}$.
5. Define linear momentum and give its formula.
6. As your mum and your auntie were traveling for your visitation, they noticed they jerked forward and backward every time the taxi suddenly reduced and increased its speed. Can you explain what was happening to your mother and auntie as a physics student?
7. Your young brother was pushing a 20 litre jerry can full of water when suddenly his friend also joined him and pushed it in the opposite direction. They both were pushing the jerry can but from the opposite direction to each other. Your mum noticed that the jerry can your brother was pushing stopped moving once his friend also pushed in the opposite direction. Explain using the knowledge of Newton's Laws of Motion what was happening to the jerry can and what is the net force acting on the jerry can if it was in equilibrium?
8. Describe an everyday situation where Newton's third law of motion is applicable?
9. Define impulse and state its units of measurement.
10. Explain the relationship between impulse and change in momentum.

Item 2:

Use your physics knowledge to work out these problems faced in our daily life as we live on with our everyday lives.

1. Your father drives to work every day and he described his journey to you as follows: He starts the car at 6:20 am, in order for him not to be late for work he needs to reach the highway by 7:00 am. He therefore accelerates uniformly from your house to the highway at a velocity of 85 ms^{-1} and he makes it there in time. He then maintains the speed up to 7:20 am and reaches the parking yard at work at 7:30 am. Draw a velocity time graph for

your father's journey from home to work. And also calculate the total distance covered by him.

2. You recently visited your big brother at campus one weekend during your holidays; he is doing a Bachelor's degree in Law. He took you for swimming at some hotel and as you were just about to start swimming, he asked you a question about the appearance of the water and he was wondering why the deeper level of the pool seemed shallower to his eyes despite the 3.3m deep indication mark at that side of the pool. Help him understand why he saw that while at the pool. Further help him to find the refractive index of the swimming pool if that of air is 1 and assume the light is traveling from air to water. (First show the illustration)
3. Your brother has two toys, A and B whose mass is 500g and 1kg respectively. If he pushes toy A at a velocity of 0.7 ms^{-1} and it collides with toy B at rest. They both move with the same velocity after collision. Find the velocity at which they travel with after collision.
4. Every evening, Dreamland SS Football Team goes to the training pitch for training and one of the footballers kicks a ball vertically upwards with an initial velocity of 30 ms^{-1} . Calculate:
 - a) The maximum height the ball reached.
 - b) The time taken to reach the maximum height.
5. A 1200 kg car traveling at 20 ms^{-1} collides with a stationary truck. After the collision, the car rebounds in the opposite direction with a speed of 10 ms^{-1} . If the collision lasts for 0.1 seconds, calculate:
 - a) The change in momentum of the car during the collision.
 - b) The impulse experienced by the car during the collision.
 - c) The average force exerted on the car during the collision.