I'm human

Exercices corrigés mouvement seconde

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Exercice 1 Un caméscope filme la chute d'une balle dans l'air. Les positions de la balle sont ensuite visualisées à intervalles de temps τ (environ 1/25 s) grâce à un logiciel. La distance parcourue par la balle est mesurée et affichée dans un tableau. Les étudiants doivent représenter la distance parcourue en fonction du temps, puis répondre à deux questions : * Est-il proportionnel entre la distance parcourue et le temps ? * Le mouvement de la balle est-il uniforme, accéléré ou ralenti ? **Correction** La courbe obtenue n'est pas linéaire, ce qui signifie que la distance parcourue n'est pas proportionnelle au temps. La balle décrit un mouvement accéléré. **Exercice 2** Une fronde est étudiée en photogrammétrie (chronophotographie). L'objectif est de comprendre le sens où l'on dit "prendre la tangente". Les positions de la fronde sont visualisées à intervalles de temps τ (28 ms). Les étudiants doivent : * Caractériser la trajectoire du point C avant le lâcher de la boule * Déterminer si le mouvement du point C est uniforme, accéléré ou ralenti * Comprendre le sens où on dit "prendre la tangente" **Correction** Avant le lâcher, le mouvement est circulaire. Lors de la première phase après le lâcher, le mouvement est ralenti. Après cela, la trajectoire devient rectiligne et uniforme. Le sens où on dit "prendre la tangente" vient du fait que la direction prise par la boule correspond à la tangente en un point donné (ici, C13) au cercle de centre O. **Exercice 3** Une pomme est mesurée pour étudier l'équilibre d'un objet soumis à deux forces. Les étudiants doivent vérifier que lorsqu'un objet est en équilibre par rapport à un référentiel terrestre, les deux forces s'annulent. Ce sont les trois exercices du texte original, paraphrasés pour faciliter la compréhension et la clarification des concepts. **Introduction** An apple is at rest with respect to a classroom. The objective is to recall characteristics of two forces that cancel each other out, identify the weight of the apple, and determine the two forces acting on it. **Correction** 1. Characteristics of two forces that cancel each other out: Two forces with the same direction, value, but opposite senses, resulting in a vector sum equal to zero. 2. Weight of the apple: The dynamometer measures both the force exerted by the apple and the force applied to it. The weight is approximately 2 N. **Forces Acting on the Apple** The apple is subject to its own weight (P) and the tension of the thread (T). Since the object is at rest, it is subjected to forces that cancel each other out, which is a reciprocal of the principle of inertia. * Point of application: Center of gravity G * Direction: Vertical through point G * Sense: From top to bottom * Value: P = m × g (in Newtons) * Point of application: Attachment point A * Direction: Vertical through point A * Sense: From bottom to top * Value: T = P = m × g (in Newtons) **Schema** [Insert schema diagram] **Inertial Principle Recognition** The correct formulation of the inertial principle is recognized. The reference frame is a terrestrial one. **True or False Statements** 1. If the forces applied to an object cancel each other out, then its velocity is always zero. 2. If the forces applied to an object cancel each other out, then the object is at rest or has rectilinear uniform motion. 3. An object launched vertically upwards will have its center of mass annihilate at the maximum altitude before falling; at this instant, the forces acting on the object cancel each other out. 4. The external forces acting on a car traveling at constant speed on a flat road cancel each other out. **Corrections** * Statements 2 and 4 are true. * If the forces applied to an object cancel each other out, then the object is at rest or has rectilinear uniform motion. * The external forces acting on a car traveling at constant speed on a flat road do indeed cancel each other out. **Soap Film Exercise** Kevin proposes launching a soap film on a smooth, carped floor. He claims that the soap film will describe rectilinear uniform motion. Marie argues that the soap film will stop due to its weight. 1. What assumptions must Kevin make to justify his statement? 2. Is Marie correct? Why or why not? 3. In reality, it is observed that the soap film stops after a certain time. **Answers** * 1. Kevin assumes that friction is negligible: The soap film glides on the smooth floor. * 2. Marie is incorrect. The weight of the soap film is a vertical force, which cannot stop its motion. * a) The movement is one of deceleration and eventual stopping. * b) This can be deduced by considering the forces acting on the soap film: its own weight (vertical) and the reaction force from the floor (also vertical), which cancel each other out. 1. The movement that occurs horizontally. 3. The savonnette stops at a moment: a) In this case, the movement of the savonnette is rectilinear and delayed or slowed down. b) One can deduce that there are significant friction forces. 8) Exercise 18, page 104. The motion of a ball: We have realized a chronophotography of a ball launched in a direction making approximately 45 ° with the horizontal. The ball is only subject to its weight. The duration between two points is 1/25 s. Using a paper-calque, reproduce the trajectory. Project the position of the ball on both axes: vertical and horizontal. Horizontal axis: a) Characterize the projected movement on the x-axis. b) Is this result in accordance with the principle of inertia? Vertical axis: a) Characterize the projected movement on the y-axis. b) Is this result in accordance with the principle of inertia? Animation: Study chronophotography and animation using CabriJava Video01 Video02 Image01 image02 You can work on the image with a drawing software like PHOTOPHILTRE. You can insert the image into a WORD page and work with the drawing tool of WORD. Projections on axes: - Vertical axis 1: - Vertical axis 2: - Projection on the x-axis: a) The projected movement on the x-axis is rectilinear and uniform. b) This result is in accordance with the principle of inertia. The applied force to the system is the weight - The weight is a force in the vertical direction. It does not affect the horizontal motion. The motion includes two phases: - During the ascent, the movement of the ball is slowed down or delayed. - During the descent, the movement of the ball is accelerated. b) This result is in accordance with the principle of inertia. - The system is subject to its weight - a force in the vertical direction that modifies the vertical motion of the system. Exercise 10, page 240: a) A arrow's speed is 30.0 m/s when it leaves an arc. - What is its speed in km/h? b) For a satellite to escape Earth's attraction, it must have a speed greater than 40 × 103 km/h. - Express this speed in m/s. Exercise 15, page 240: a) During the free fall of an object without initial velocity, the height of fall is proportional to the square of the time elapsed: . - Express and calculate the duration it takes for a tennis ball to reach the ground when it is released from a height of one meter without initial velocity. - Data: g = 9.8 N/kg b) Represent the chronophotography of this motion between 0 s and 1 s, with an interval of time of 0.1 s. - Table of values: t s 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 h m (real) h cm (schema) **Initial Situation** * Gravitational acceleration: 9.8 N/kg * No expression or value provided for time duration **Chronophotography Representation** * Represent the movement between 0 seconds and 1 second, with a time interval of 0.1 seconds. * Scale: 4 cm = 1 m **Exercise 18 (page 241)** For a commercial film about car tires, two cameras are used: * Camera 1 is attached to the car and directed towards the tire's axis. * Camera 2 is placed on the road and records the car passing by at reduced speed. A white mark was made on the tire, and a green mark was made on the center of the wheel. The tasks are: a) Provide the trajectory of the white mark (yellow) observed by Camera 1. b) Provide the trajectory of the green mark for the same camera. c) Provide the trajectory of the green mark observed by Camera 2. d) Provide the trajectory of the white mark (yellow) observed by Camera 2. e) Which camera is part of the terrestrial reference frame? **Results** a) The white mark (yellow) follows a circular path in the reference frame linked to the car. b) The green mark remains stationary in the reference frame linked to the car. c) The green mark moves along a straight line relative to Camera 2 on the road, which is part of the terrestrial reference frame. d) The white mark (yellow) follows a cycloid path in the reference frame linked to the road. e) Camera 2 belongs to the terrestrial reference frame because it is placed on the road and remains stationary relative to it. **Application: TP Physics N° 08 - Principle of Inertia** * Bouncing ball experiment: + Ball diameter: 10 mm + Ball mass: 4.08 g + Ball density: 7563 kg/m³ + Oil density: 920 kg/m³ * A ball is released without initial velocity into a vat of oil. * The motion is recorded by chronophotography, with the camera taking 50 images per second. **Question** In what reference frame is the ball's motion studied? The reference framework related to the marble movement is described as follows. The marble's motion is linear and consists of two phases. In the first phase, the velocity increases and the acceleration occurs. In the second phase, the distances traveled are equal and the duration is uniform, resulting in a steady motion. To determine the average speed vmoy of the marble between its extreme positions, the calculation is required. Furthermore, it is necessary to find the instantaneous velocity at times t8 and t14. It is determined that from position 12 onwards, the forces acting on the marble have compensating effects, which is referred to as the limiting speed vlim. The motion of the marble can be considered almost linear and uniform after this point. Using two methods, the value of vlim can be calculated. The first method involves calculating the average speed between positions t12 and t22 using the formula vmoy = v (t). The second method involves calculating the instantaneous velocity at time points such as...