INSTITUT SAINT JEAN

Tél : (+237) 657 07 98 07
(+ 237) 651 36 96 96
B.P : 749 Yaoundé, Cameroun
Email : info@institutsaintjean.org
www.institutsaintjean.org

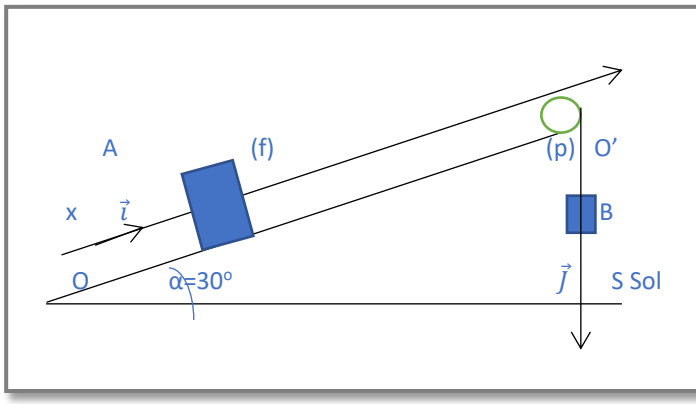
CONCOURSD'ADMISSION
SERIE GCE

EPREUVE de physique
Durée : 2 Heures

Exercise 1: Movement in force fields and their applications / 08 Marks

***Part A* : Applications of the laws of Newton /5,5 Marks**

We consider the device of the figure opposite. A and B are two solids of the same masses: **m=m' =1 kg**. **(f)** is an inextensible thread of negligible mass**. (P)** is a negligible mass pulley of radius **R=10 cm**. Friction is negligible. We will take **g=10 N/kg**. At the date **t=0 s**, the solid A except for O, the lower end of the inclined plane without initial velocity while the solid B is by O'.



1.1 What is physically translated by the expression << **a pulley of negligible mass** >> **0,5mk**

1.2 Represent all forces exerted on **A and B**. **1,5mk**

1.3 State the theorem of the center of inertia **1mk**

1.4 By applying the center of inertia theorem to each of the two solids A and B, show that the expression of the acceleration of the body A : $\mathbf{a}=\frac{(m'-m\sin\alpha)g}{m+m'}$. **0,5mk**

1.5 Calculates the value of **a**. **0,5mk**

1.6 Establish the time equation of the motion of the solid B in the reference frame $(O,\vec{j})$ **0.5mk**

1.7 Determine the date t_1 of the solid B to the ground knowing that **O'S= 1,25m**. **0.5mk**

1.8 Determine the velocity acquired by solid A and its abscissa in the reference frame $(O,\vec{I})$ at time t_1. **0.5mk**

***Partie B* : Force and electrostatic fields / 2,5marks**

1. Two point electrical charges $Q_A= 2x10^{-6}$ **C et** $Q_B=5x10^{-6}$ **C** are placed at two points A et B **36 cm** apart**.**

1.1. Represent the electrostatic fields created by QA and QB at point **M**, middle of **[AB]. 1 mk**

1.2. Calculate the modulus of the electrostatic field in **M**, middle of **[AB]. 0.5 mk**

1.3. A positive point charge is placed in **M** $Q_M = 3x10^{-6}$**C** . Is the Q_M load in equilibrium? Justify. **1 mk**

Exercice 2 : Vibratory and corpuscular phenomena / 8,5 marks

***Partie A* : Mechanical wave/ 4,5 marks**

Two fixed points produce at two points S_1 and S_2 of the surface of a liquid, vibrations of amplitude equal to **2 mm**. This results in the formation of a system of interference fringes on the surface of the liquid.

2.1. What are the conditions verified by S_1 and S_2 during this experiment? **1mk**

2.2. The wavelength of the vibrations is **λ=2,4cm** and their speed is **C= 1.2m /s**

2.2.1 Calculate the period and frequency of sources S_1 et S_2. **1.5 mk**

2.2.2. Calculate the amplitude of vibration of the point **M** knowing that MS_1**=13cm et** MS_2**=7cm.** **1 mk**

2.2.3. Calculate the amplitude of vibration of the point **M'** knowing that $M'S_1$**=6.5cm et** $M'S_2$**=13.7cm** **1 mk**

<u>Partie B</u> : Radioactivity /4 marks

Polonium $^{210}_{84}Po$ undergoes alpha-type decay, its radioactive half-life is **T=138 days**

2.1. Give the meaning of the numbers **84** and **210** and the composition of the nucleus **1mk**

2.2. Write the equation for the radioactive decay of polonium. An extract from the periodic table is given: $_{82}Pb$; $_{83}Bi$; $_{85}As$; $_{86}Rn$. **1 mk**

2.3. Define the period of a radioelement and then calculate the radioactive constant λ of polonium. **1 mk**

2.4. At **t=0** the initial number of polonium nuclei is N_o**=8x10^{20}**. What is the number of nuclei remaining after a time **t = 276 days** **0,5x 2 mk**

<u>Exercice 3</u> : Physics experience / 4,5pts

A cesium cathode photocell is illuminated successively by monochromatic light beams of the same power **P =50µW** but with a different frequency υ. For each of these radiations, the value of the voltage which cancels the intensity of the photoelectric current is recorded. We obtain the following results

υ(10^{14} Hz)	**5.18**	**5.49**	**6.15**	**6.88**	**7.41**
U_0 (V)	**0.24**	**0.36**	**0 .62**	**0.93**	**1.15**

3.1. Define photoelectric effect **0.5 mk**

3.2. What is the relation between U_0**, υ, h, e ?** **0.75 mk**

3.3. Plot the function U_0**=f(υ). Scale: 2 cm for 10^{14} Hz and 10 cm for 1V.** **1.75 mk**

3.4. What is the nature of the curve you obtained? **0.25 mk**

3.5. Using the graph, determine the threshold frequency $υ_o$**.** **0.5 mk**