Work and Energy Chapter IV Work and Energy The objective of this chapter is to introduce the energy tools used in mechanics to solve problems.Kinetic Energy Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 9 Work and Energy Chapter IV The Kinetic Energy Theorem Ek B - Ek A = ?WAB F ?ext Demonstration Consider a particle moving under the action of a resultant force F -> between A and B. The work done by F -> for an elemental displacement dr -> is : dW = F -> ?Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 18 Work and Energy Chapter IV Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 19 Work and Energy Chapter IV Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 20 Work and Energy Chapter IV Solution Calculation of the total mechanical energy at equilibrium: We know that : ET = Ek + Ep At equilibrium: - the velocity of the system is zero V = 0 => Ek = 0 - and the potential energy of the system Ep = Ep(elastic) + Ep(gravitational) So: Ep = 1 2 kx 2 + mgh NA: Ep = 1 2 200(0.02) 2 + 0.1 x 10 x 0.5 = 1.54 J Hence, the total mechanical energy at equilibrium: ET = Ep = 1.Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 5 Work and Energy Chapter IV B- Work of a variable force When force is variable, the calculation of work for this variable force involves first defining the increment of work, denoted as dW, done by a force F ?No Work Done Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 4 Work and Energy Chapter IV Exercise 1 A body weighing 4 kg ascends a ramp inclined at 30o over a distance of 15 m. The driving force is F = 30 N. Calculate the work done by each force acting on this body.Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 15 Work and Energy Chapter IV Examples of potential energy a) Gravitational potential energy Ep = mgh + Cst If we set Ep =0 for h=0, then the constant (Cst) is equal to 0 Gravitational potential energy m h It is the energy that a body possesses due to its position in a gravitational field Work and Energy Chapter IV b- Elastic Potential Energy It is potential energy stored as a result of deformation of an elastic object such as spring.Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 12 Work and Energy Chapter IV Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 13 Work and Energy Chapter IV Exercise 4 : A particle of mass m moving along a straight trajectory is subjected to a force F(x), the variations of which with respect to x are depicted in figure below.Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 1 Work and Energy Chapter IV A- Work done by a constant force work done by a constant force F -> during a rectilinear displacement AB, is defined as the scalar product of the force F -> and the displacement AB. WAB(F ?0 5 10 15 20 25 30 0,0 0,5 1,0 x(m) F(N) Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 14 Work and Energy Chapter IV 4.Potential energy The kinetic energy Ek of a particle is associated with its motion.dr -> Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 6 Work and Energy Chapter IV Exercise 2: A body m is subjected to a force F -> , moving along the trajectory OABCO, as shown in figure opposite.Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 8 Work and Energy Chapter IV Kinetic energy Ek , is the energy possessed by an object due to its motion.= m dV dt Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 10 Work and Energy Chapter IV We substitute the expression for F -> into equation (*): (*) => dW = m dV dt ?< 0 negative work Dr IACHACHENE FARIDA FHC-UMBB-2024-2025 3 Work and Energy Chapter IV ?acting through an infinitesimal displacement dr ?.Introduction 2.1.?0