



Sequence 11: Mechanical energy



Fiche de synthèse mobilisée (collection en français) :

- Fiche n°11 : énergie mécanique



Sommaire des activités ETLV :

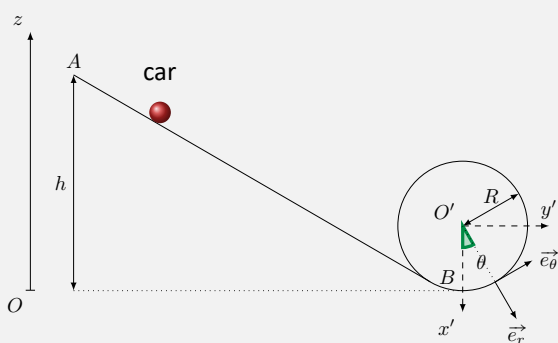
- ACTIVITY 1: Energy in a fun ride
- ACTIVITY 2: Using energy to solve a problem

ACTIVITY 1: Energy in a fun ride

Objective: to learn about mechanical, kinetic, and potential energy.

DOCUMENT 1: The roller coaster

In this document we have simplified the trajectory of a car on a roller coaster. Its mass is $m = 10$ tons. Let's suppose its movement starts on point A where it slides down a slope until point B. Then, the car enters a loop where it can turn upside down a series of time.



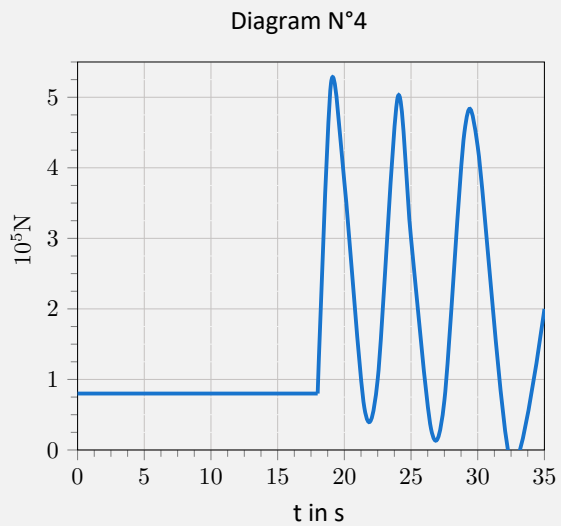
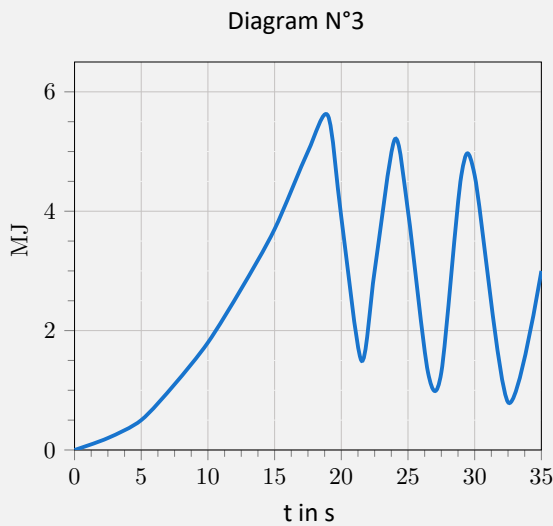
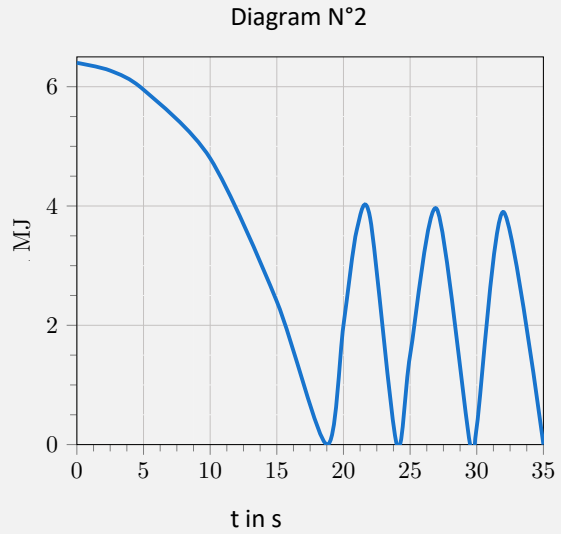
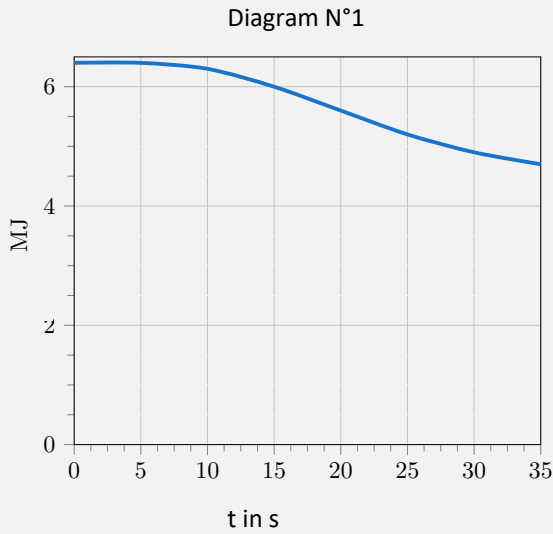
Source: Wikimedia commons, rollercoaster dragon khan universal Port Aventura Spain

DOCUMENT 2: Gravity constant

We will be able to use the gravity constant $g \approx 10 \text{ m} \cdot \text{s}^{-2}$.



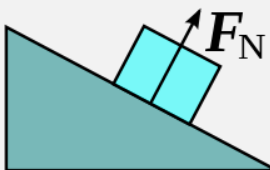
DOCUMENT 3: Energy and force diagrams



A computational simulation of the trajectory of a car is carried out. In these diagrams, the kinetic energy E_c , the potential energy E_p , the mechanical energy E_m of the car, as well as the normal force of the rails are represented.

DOCUMENT 4: The normal force

In mechanics, the normal force F_N is the component of a contact force that is perpendicular to the surface that an object contacts. In this instance normal is used in the geometric sense and means perpendicular, as opposed to the common language use of normal meaning "ordinary" or "expected". A person standing still on a platform is acted upon by gravity, which would pull them down towards the Earth's core unless there were a countervailing force from the resistance of the platform's molecules, a force which is named the "normal force".



Source: Wikipedia and Wikimedia commons



■ **Understanding:**

Identify each diagram in document 3 and explain your reasoning.

Is friction considered in the simulation? Explain.

■ **Understanding:**

Give a list of the words and expressions in the previous documents that you are not familiar with:

Fill in the table below:

English	French
	énergie mécanique
	énergie potentielle
	énergie cinétique
	réaction normale au support
	les frottements
	la hauteur
	la vitesse
	le chariot

ACTIVITY 2: Using energy to solve a problem

Objective: to use the different forms of energy to solve a problem

■ **Analyzing:**

Using document 3, compute the initial height of the car.

Compute the initial velocity of the car.

Again, using document 3, compute the maximum velocity reached by the car in this simulation.

■ **Problem:**

What would be the maximum velocity reached by the car if friction was neglected?



Activity summary

What you must remember:

- **mechanical, potential, kinetic energies**
- **velocity**
- **height**
- **friction**

Skills linked to the curriculum:

Compétences	Capacités à maîtriser	Où dans cette séquence ?
APP	<ul style="list-style-type: none">• Utiliser du vocabulaire spécifique	Activité 1
	<ul style="list-style-type: none">• Lire et comprendre des documents scientifiques	Activité 1
ANA	<ul style="list-style-type: none">• Citer et exploiter la relation définissant l'énergie potentielle de pesanteur.	Activité 1
	<ul style="list-style-type: none">• Citer et exploiter la relation définissant l'énergie mécanique.	Activité 1
	<ul style="list-style-type: none">• Exploiter la conservation de l'énergie mécanique.	Activités 1 et 2
	<ul style="list-style-type: none">• Analyser les transferts énergétiques au cours du mouvement d'un point matériel.	Activités 1 et 2
	<ul style="list-style-type: none">• Associer une variation d'énergie mécanique au travail des forces de frottement.	Activité 1
	<ul style="list-style-type: none">• Exploiter des documents pour estimer l'énergie stockée dans un réservoir d'énergie mécanique.	Activités 1 et 2