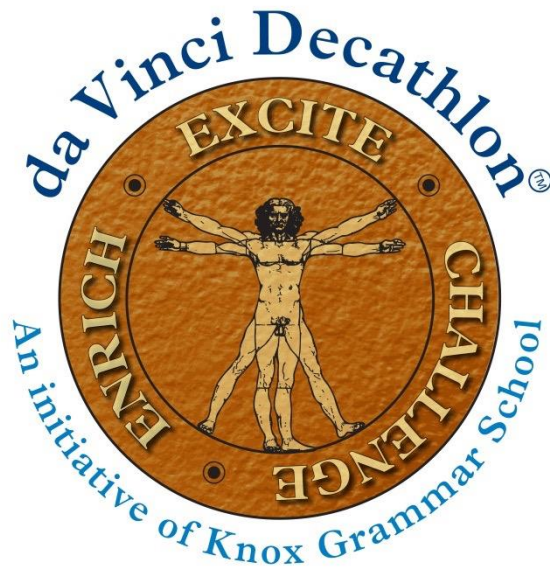




STATE DA VINCI DECATHLON 2017

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS
IN YEARS 7 & 8



ENGINEERING

TEAM NUMBER _____

HYDROELECTRIC POWER & PUMPED-STORAGE HYDROELECTRICITY

BACKGROUND

Modern societies have traditionally utilised energy sources such as coal, oil and natural gas to meet their mechanical and electrical power needs. These fossil fuels are non-renewable and contribute to global environmental issues such as pollution and global warming. Increasingly, alternatives to fossil fuels are providing a much greater share of our power requirements and in a much more sustainable way. Nuclear energy is very efficient but also has its drawbacks, as nuclear waste is radioactive and difficult to manage. Renewable energy sources such as solar, geothermal, hydroelectric and wind are very much more sustainable and will take the place of fossil fuels to provide our mechanical and electrical power in the future. One problem with these renewable energy sources is that they produce energy intermittently i.e. solar energy is only produced when the sun is shining. It is difficult to store the energy produced by these sources, to provide power at all times on demand.



Hydroelectric power is generated directly as water flows past and spins a turbine. If intermittent renewable energy sources like solar and wind can be used to pump water from a lower elevation to be stored at a higher elevation, then it can be released to flow under gravity past the turbine, generating power when required. This is called Pumped-storage hydroelectricity (PSH).

THE TASK

Your task is to design and create a model of a PSH station. Your model should incorporate lower elevation and higher elevation water storage areas and a turbine or water wheel that spins. You need to include the pipes for water flow as it is pumped from the lower to the higher elevation, and as it is released past the turbine. These should all be clearly labelled on your model.

DESIGN PARAMETERS

You will have **sixty minutes** to design and construct a model of a PSH station. You will receive a piece of A3 paper on which to attach your model, and on which you will write your design brief.

You will be marked according to the following:

- Originality of design, and aesthetics
- Stability of the PSH and the quality of the construction
- The inclusion of:
 - the lower elevation and higher elevation water storage areas
 - a turbine or water wheel that spins
 - pipes for water flow as it is pumped to the higher elevation, and as it is released past the turbine
- Design brief
 - Your design brief will need to describe all features of your PSH.

You are restricted to using the following materials but you do not have to use them all:

- 10 sheets of A4 paper
- Sticky tape
- 6 straws
- 2 drawing pins
- A3 presentation sheet on which to attach your PSH model and write your design brief

TESTING CONDITIONS

- Your model must remain stable and upright and be **attached** to your A3 presentation sheet.
- Your turbine, or waterwheel must spin freely.
- Your model must be clearly labelled.
- The design brief must clearly describe the design of the PSH model and the features that you have included.

TEAM NO.:.....

DESIGN DETAILS (5 MARKS)

1. Describe how and why you have designed the PSH Station (3 marks)

2. Explain how you have addressed the factors in the background information and design brief. (2 marks)

DESIGN SKETCH (5 MARKS)

Briefly sketch your design with approximate proportions, labelling any important features. Transfer these labels to the A3 sheet that your PSH Station is placed on.

MARKING GRID

Criteria	5		4		3		2		1		total
Originality of design, and aesthetics											/5
Stability of the PSH and the quality of the build											/5
Correct inclusion of the lower elevation and higher elevation water storage areas											/5
A turbine or water wheel that spins and is correctly positioned											/5
Pipes for water flow as it is pumped to the higher elevation, and as it is released past the turbine											/5
Design brief	10	9	8	7	6	5	4	3	2	1	/10
total											/35