Sample Diploma Problem

17. The technology that is currently **least able** to help meet Canada's increasing need to generate electricity is

A. wind turbines

B. hydroelectric dams

C. nuclear fusion reactors

D. nuclear fission reactors

Nuclear fusion reacts don't exist

Sample Diploma Problem

19. One of the main reasons that many countries use nuclear power plants is because they

A. are inexpensive to build

B. have a high energy output

C. create large numbers of jobs

D. do not create thermal pollution

Use the following information to answer numerical-response question 5.

Some nuclear reactors require plutonium. A reaction that involves plutonium-239 is represented by the equation below.

$$^{239}_{94}\text{Pu} + {}^{1}_{0}\text{n} \rightarrow {}^{147}_{ab}\text{Ba} + {}^{cd}_{38}\text{Sr} + 3\,{}^{1}_{0}\text{n}$$

Numerical Response

5. The numbers represented by ***a***, ***b***, ***c***, and ***d*** in the nuclear reaction represented in the equation above are 5, 6, 9, and 0.

(Record all **four digits** of your answer in the response boxes at the bottom of the screen.)

Use the following information to answer numerical-response question 6.

Equations Representing Nuclear Reactions

1 ${}_{1}^{3}\mathrm{H} + {}_{2}^{4}\mathrm{He} \rightarrow {}_{3}^{7}\mathrm{Li}$

2 ${}_{88}^{226}\mathrm{Ra} \rightarrow {}_{86}^{222}\mathrm{Rn} + {}_{2}^{4}\mathrm{He}$

3 ${}_{6}^{14}\mathrm{C} \rightarrow {}_{7}^{14}\mathrm{N} + {}_{-1}^{0}\mathrm{e}$

4 ${}_{94}^{239}\mathrm{Pu} + {}_{0}^{1}\mathrm{n} \rightarrow {}_{42}^{100}\mathrm{Mo} + {}_{52}^{134}\mathrm{Te} + 6{}_{0}^{1}\mathrm{n}$

Numerical Response

6. Match each of the equations numbered above to a type of reaction, shown below. (Use each number only once.)

Equation:	1	4	2	3
Reaction:	**Fusion**	**Fission**	**Alpha Decay**	**Beta Decay**

(Record all **four digits** of your answer in the response boxes at the bottom of the screen.)

Use the following information to answer numerical-response question 7.

Steps Used to Calculate Energy in a Nuclear Change

1 Balance the nuclear reaction.

2 Calculate the total energy released using $\Delta E = \Delta mc^2$.

3 Multiply the mass of each nuclide by the number of moles in the reaction.

4 Determine the mass change by subtracting the mass of the reactants from the mass of the products.

Numerical Response

7. When listed in order from the first step in the calculation of energy in a nuclear change to the fourth step, the steps are numbered

1	3	4	2
First step			**Fourth step**

(Record all **four digits** of your answer in the response boxes at the bottom of the screen.)

Use the following information to answer question 20.

One type of experimental nuclear fusion reactor uses two isotopes of hydrogen, hydrogen-2 (deuterium) and hydrogen-3 (tritium), to create energy.

A Nuclear Fusion Reaction

$$\underset{\text{deuterium}}{{}^{2}_{1}\text{H}} + \underset{\text{tritium}}{{}^{3}_{1}\text{H}} \rightarrow {}^{4}_{2}\text{He} + {}^{1}_{0}\text{n}$$

20. The mass that is lost when one mole of deuterium undergoes a fusion reaction with one mole of tritium is

A. 2.00×10^{-5} kg

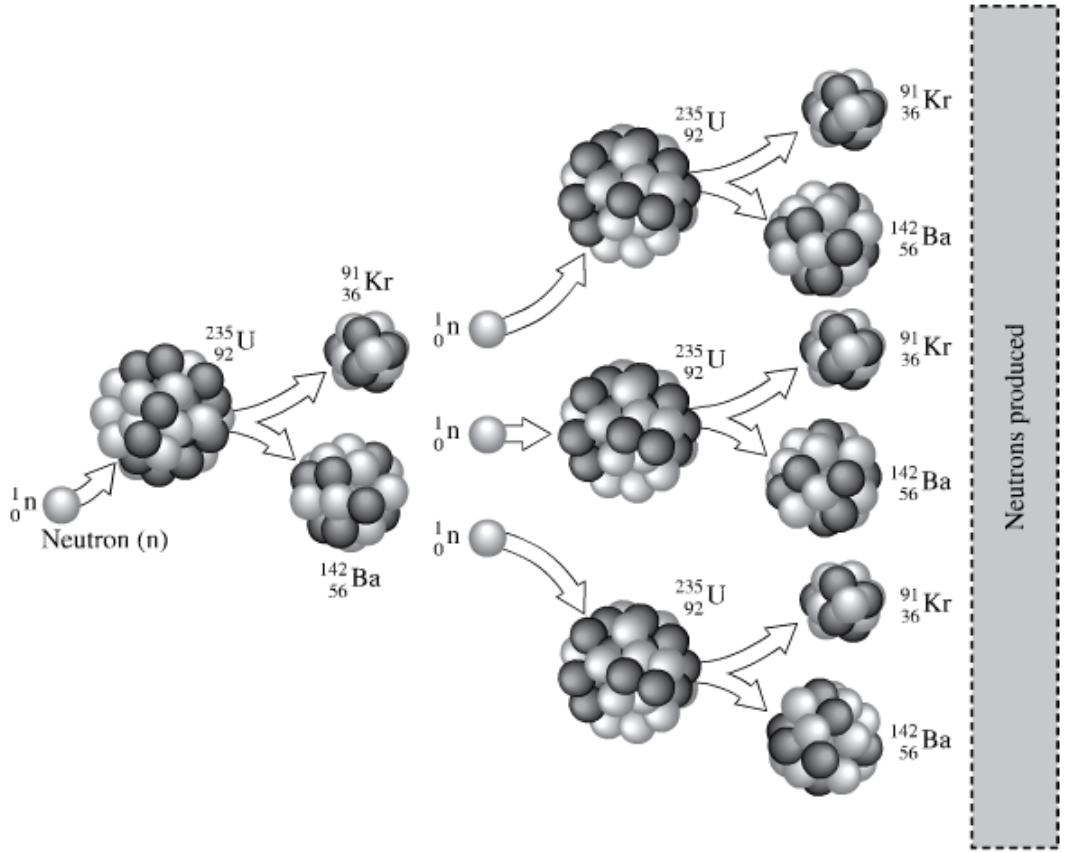
B. 1.98×10^{-2} kg

C. 6.01×10^{3} kg

D. 1.80×10^{12} kg

Use the following information to answer question 21.

Chain Reaction that Occurs in a CANDU Nuclear Fission Reactor



21. The number of neutrons that should be shown in the shaded box at the end of the chain reaction process in the diagram above is

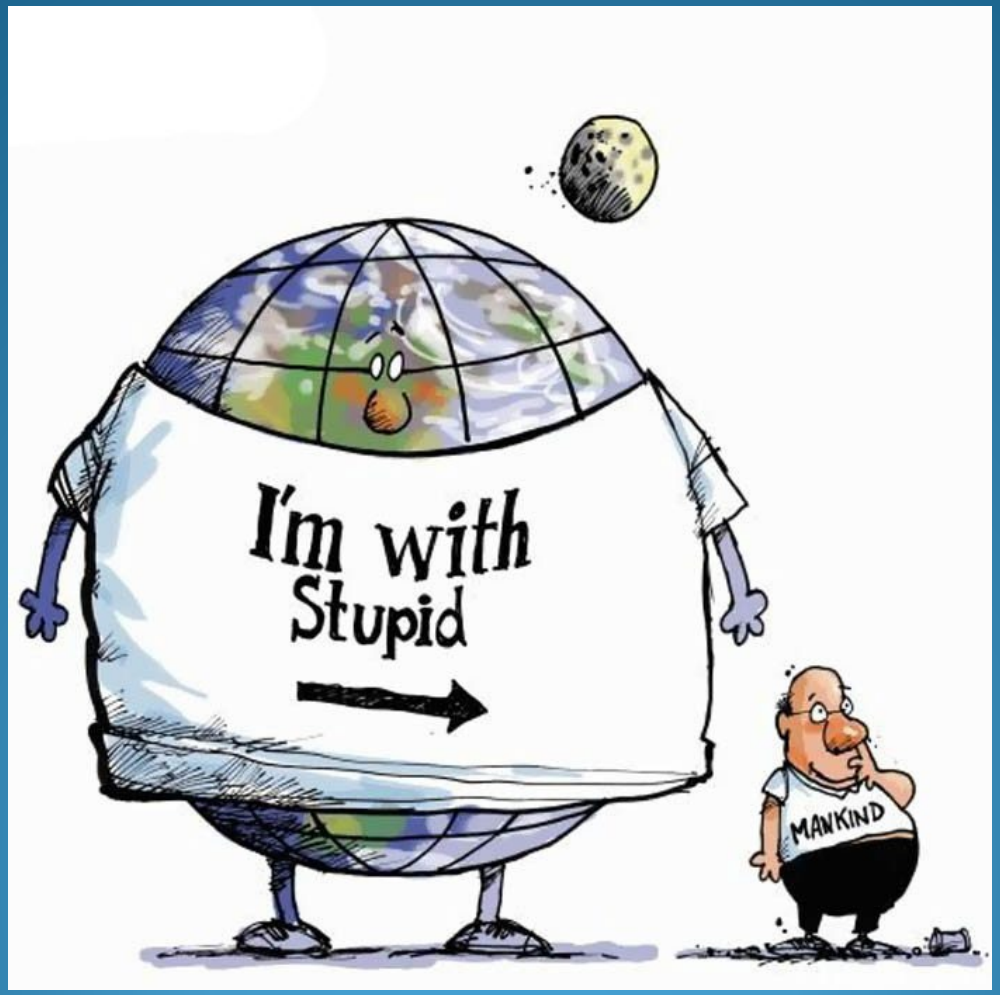
A. 3

B. 6

C. 9

D. 27

Sustainability



Curriculum

- describe the environmental impact of developing and using various energy sources; geothermal
- explain the source of tides, in terms of gravitational attraction and the relative motions of the sun, moon and Earth
- describe the energy transformations involved in converting tidal energy to electrical energy and compare tidal power to hydroelectric power
- evaluate the environmental and economic implications of energy transformation technologies;

Sustainable

- **Sustainable** is something that is capable of being maintained at length without interruption, weakening, or loss of essential characteristics such as matter and energy
- In nature, trees grow from the soil, they receive energy from rain and sun and when they die they are decomposed back into the soil so more trees can use their matter and energy
- This is sustainable, while cities where humans live are not. Why?

Sustainable Development

- These are common sense ideas such as:
  - Energy source can't run out
  - Not polluting our air or water sources
  - Not destroying habitats of organisms
  - Does not contribute to ionizing radiation
- Oil and gas industry does not provide any of these
- We must look at alternative energy sources if we want it to be sustainable
- Oil and gas will eventually run out which will also lead us into alternatives

Renewable recourses

- **Nuclear fusion** (2 small atoms combing to make 1 large)
- **Tidal** – tides occur b/c of the gravitational pull of the moon. The incoming flow of water turns a turbine
- **Geothermal** – heat that originates from the radioactive decay in the earth's core
- **Wind** – wind turns a turbine
- **Hydroelectric** – comes from moving water
- **Biomass** – plant matter used as fuel
- **Biofuel** – a fuel produced from renewable sources
- **Photovoltaic** – take the EMR & convert it

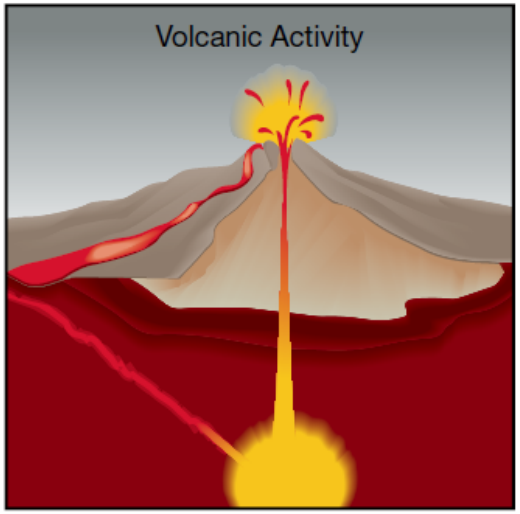
Geothermal Energy

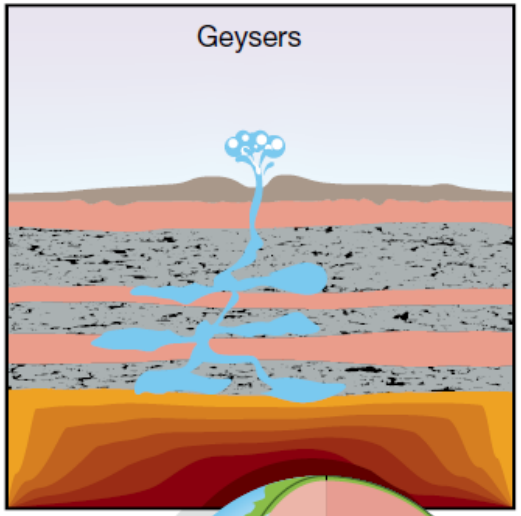
- **Geothermal energy** is responsible for the movement of tectonic plates, volcanoes and geysers
- It is caused *by heat from radioactive decay deep in the Earth's core, this drives convection currents in the mantle*
- When the crust is thin enough or has fractures it creates hotspots which allow heat to rise to the surface

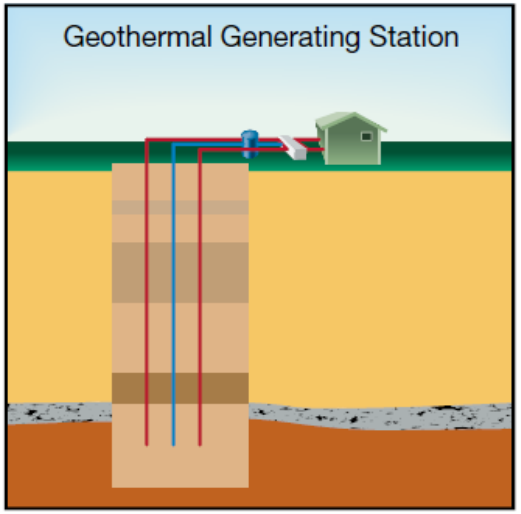
3) Earth energy systems (geothermal)

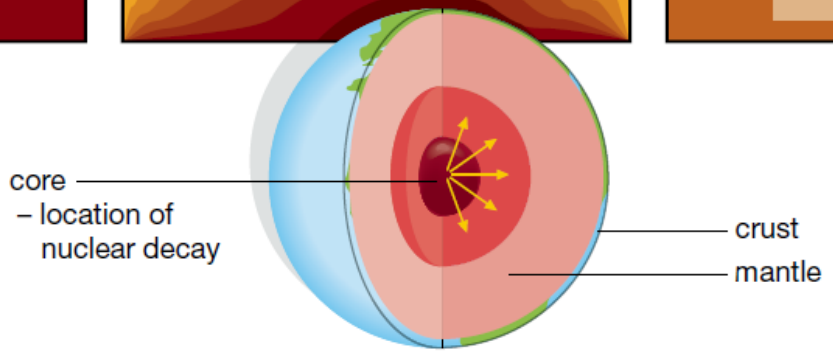
- Similar to solar panels but use a loop of piping in the ground to collect heat.
- Pipes filled with antifreeze --- heat from earth's core --- used to heat building.
- Used from the 1940's on.
- Expensive to install but little energy needed to operate = savings!

Geothermal Energy



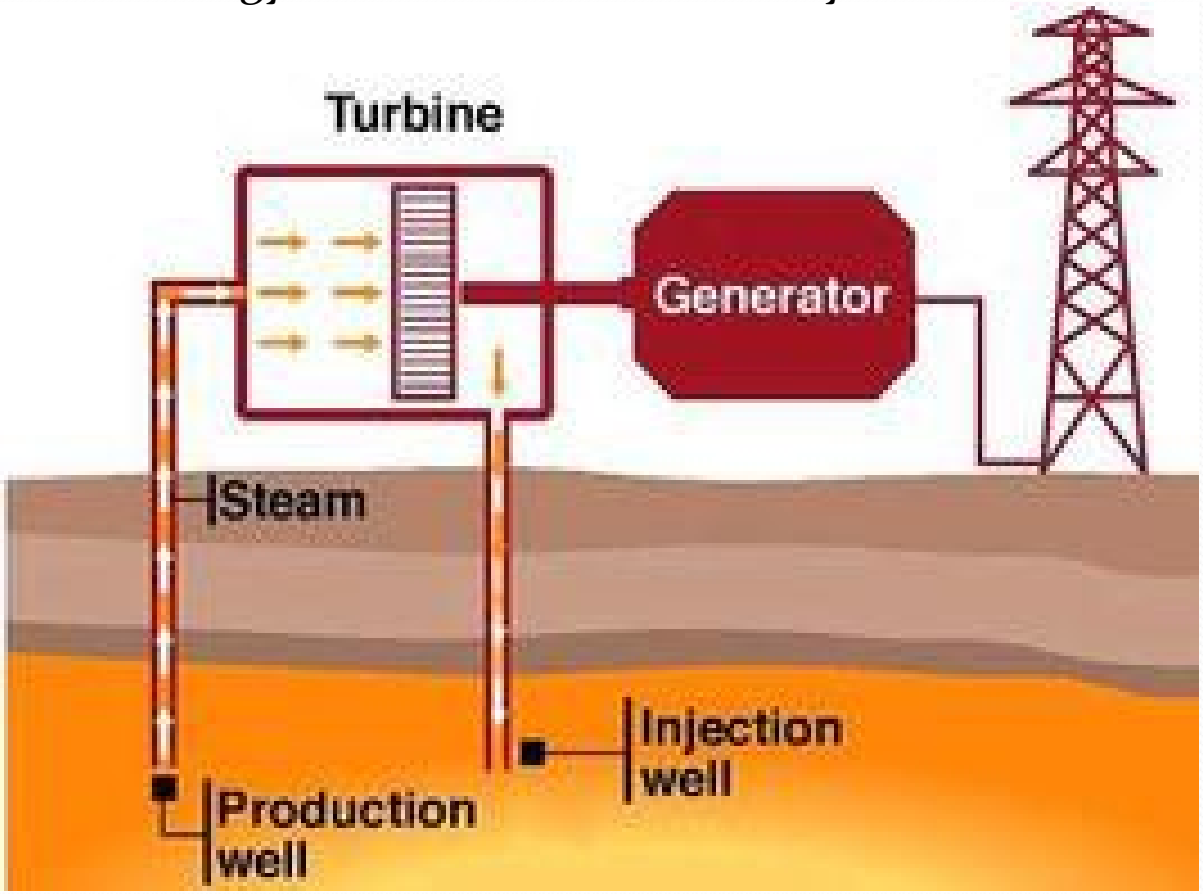






Geothermal Generator

Nuclear Energy → heat → Ek → electricity



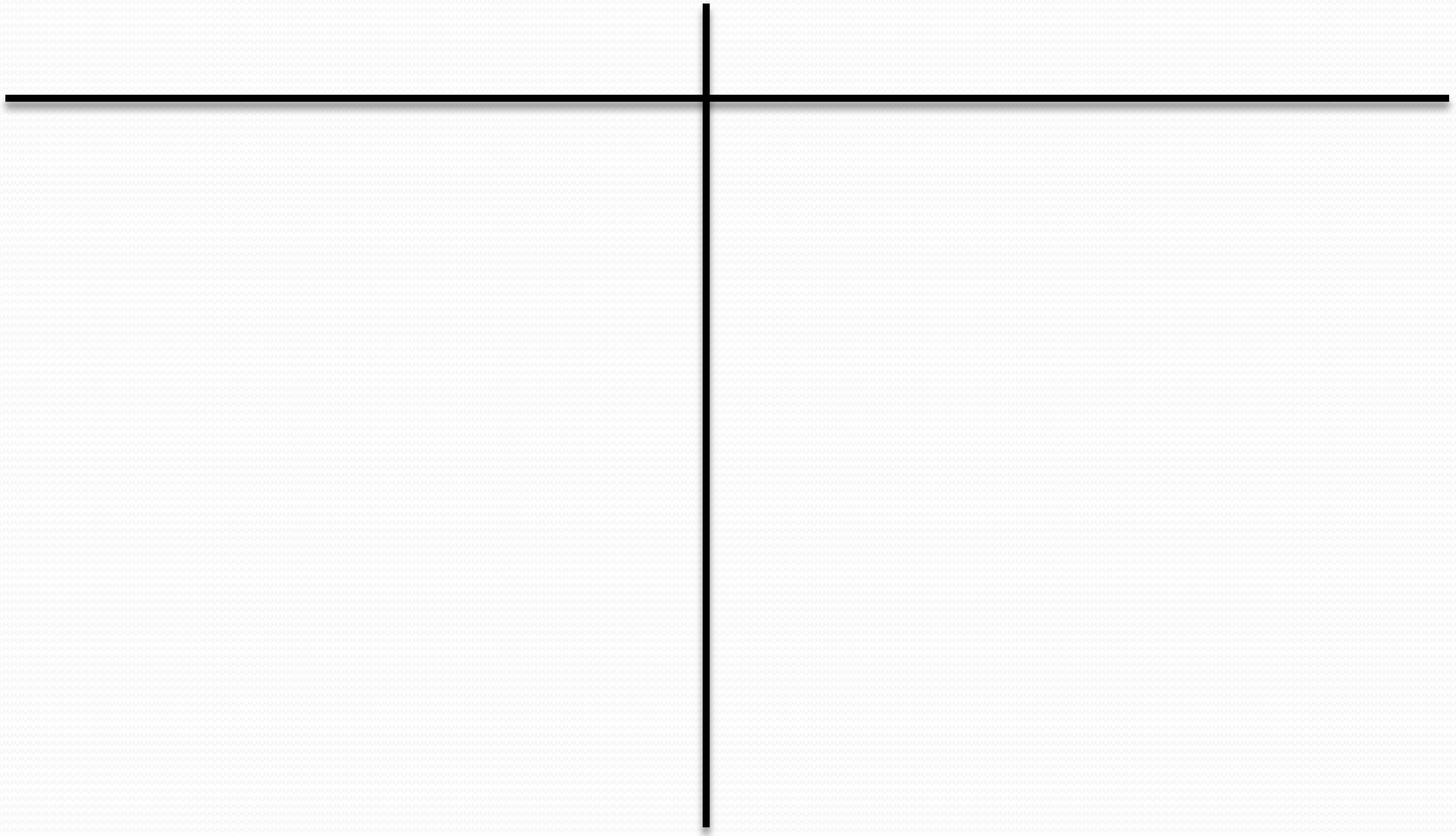
Geothermal in the World

Tectonic plates

Geothermal energy

- https://www.youtube.com/watch?v=j7q653ffQO4

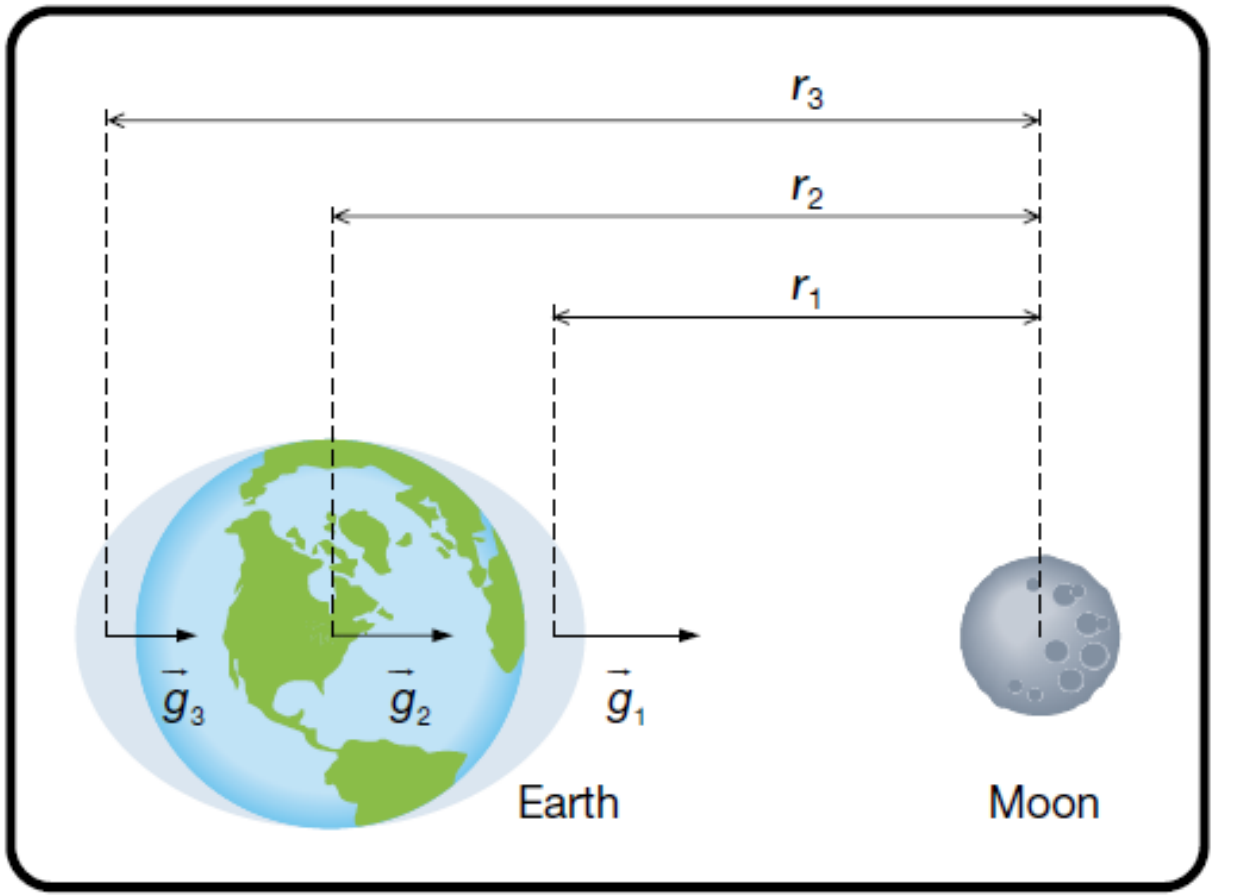
Advantages and Disadvantages



Tidal Energy

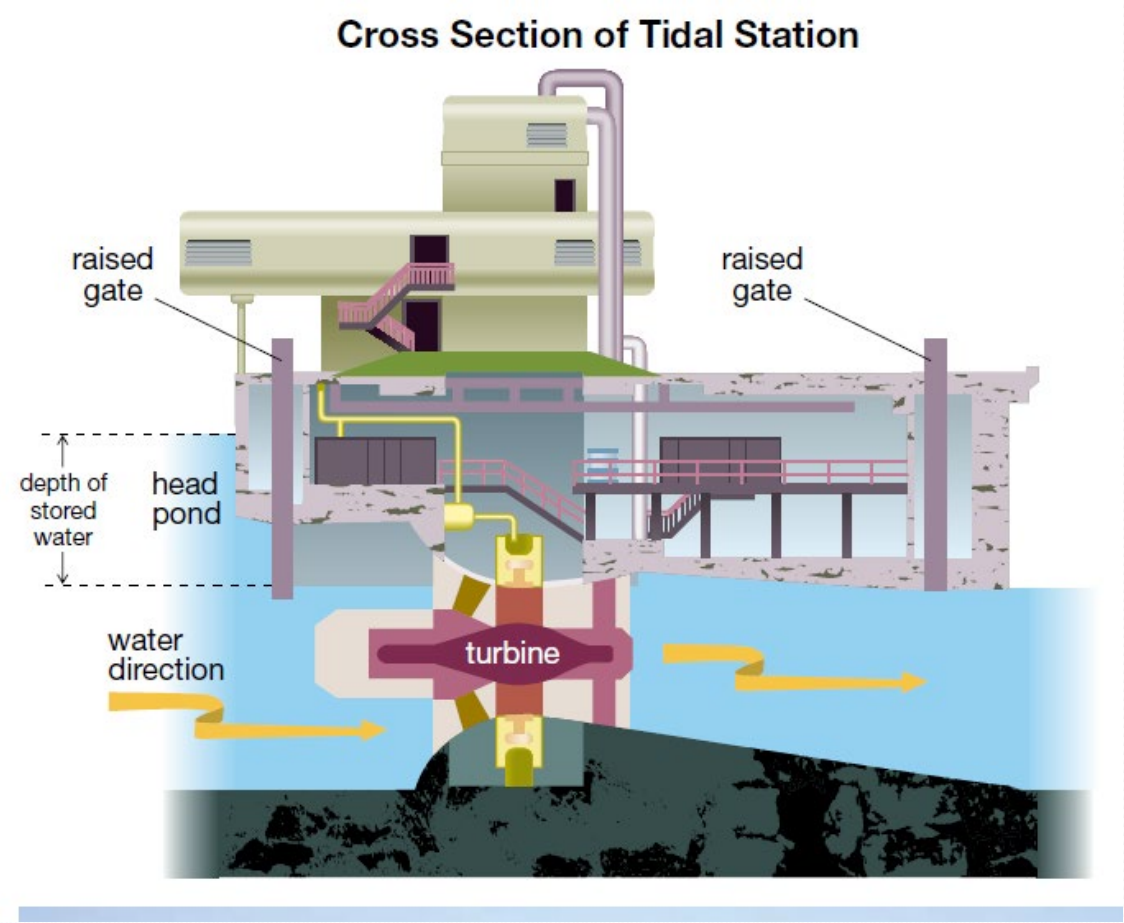
- The tides are caused by the pull on the oceans between the moon and the sun
- Because the moon is much closer it has a bigger impact on tides
- Depending on the shape of the ocean bay where water moves, 16m worth of water can drain in and out of a bay every 12 hours

Tidal Energy



Bay of Fundy Nova Scotia

Tidal Generator



Advantages and Disadvantages