

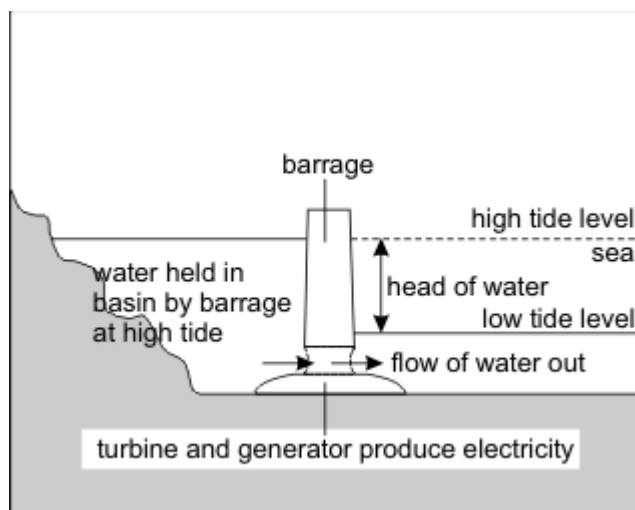
Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Q1.

The outline diagram below shows a tidal power generating system.



Gates in the barrage are open when the tide is coming in and the basin is filling to the high tide level. The gates are then closed as the tide begins to fall.

Once the tide outside the barrage has dropped the water can flow through large turbines in the barrage which drive generators to produce electrical energy.

In one second 1.2×10^9 kg of water flows through the turbines at a speed of 20 m/s.

- (a) Calculate the total kinetic energy of the water which passes through the turbines each second.

(3)

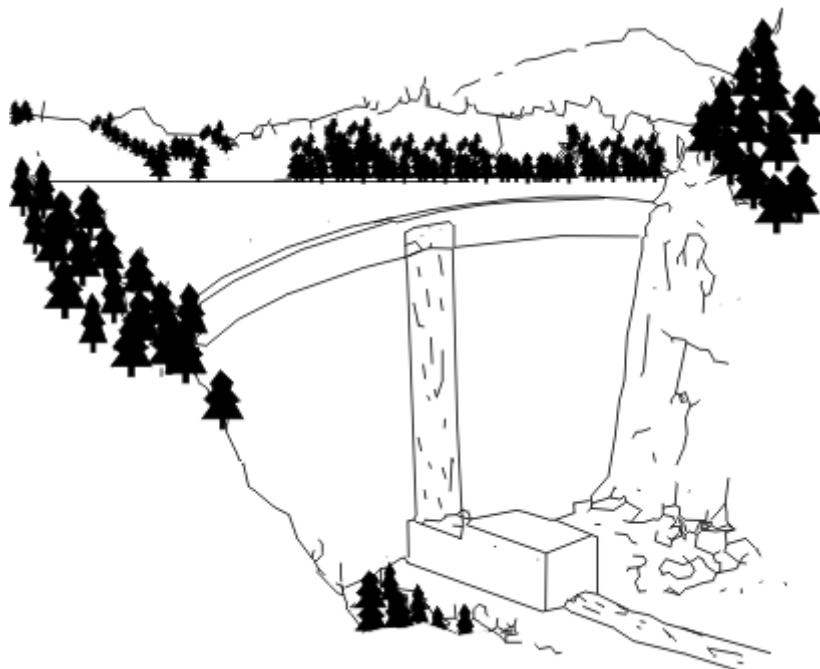
- (b) As the height of water in the basin falls, the water speed through the turbines halves.

- (i) What mass of water will now pass through the turbines each second?

- (ii) By how much will the power available to the generators decrease?

Q2.

The diagram below shows water falling from a dam. Each minute 12 000 kg of water falls vertically into the pool at the bottom.



The time taken for the water to fall is 2 s and the acceleration of the water is 10 m/s^2 .

- (a) Assume the speed of the water at the bottom of the dam is zero. Calculate the speed of the water just before it hits the pool at the bottom.

(2)

- (b) Use your answer to part (a) to calculate the average speed of the falling water.

(1)

- (c) Calculate the height that the water falls.

(2)

- (d) What weight of water falls into the pool each minute?

(2)

- (e) How much work is done by gravity each minute as the water falls?

(2)

- (f) A small electrical generator has been built at the foot of the waterfall. It uses the falling water to produce electrical power.

- (i) How much energy is available from the falling water each minute?

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- (ii) How much power is available from the falling water?

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- (iii) If the generator is 20% efficient, calculate the electrical power output of the generator.

(4)

(Total 13 marks)