Density

Question Paper 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Density
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 2

Time Allowed: **77 minutes**

Score: **/64**

Percentage: **/100**

1 Fig. 3.1 shows a water turbine that is generating electricity in a small tidal energy scheme.

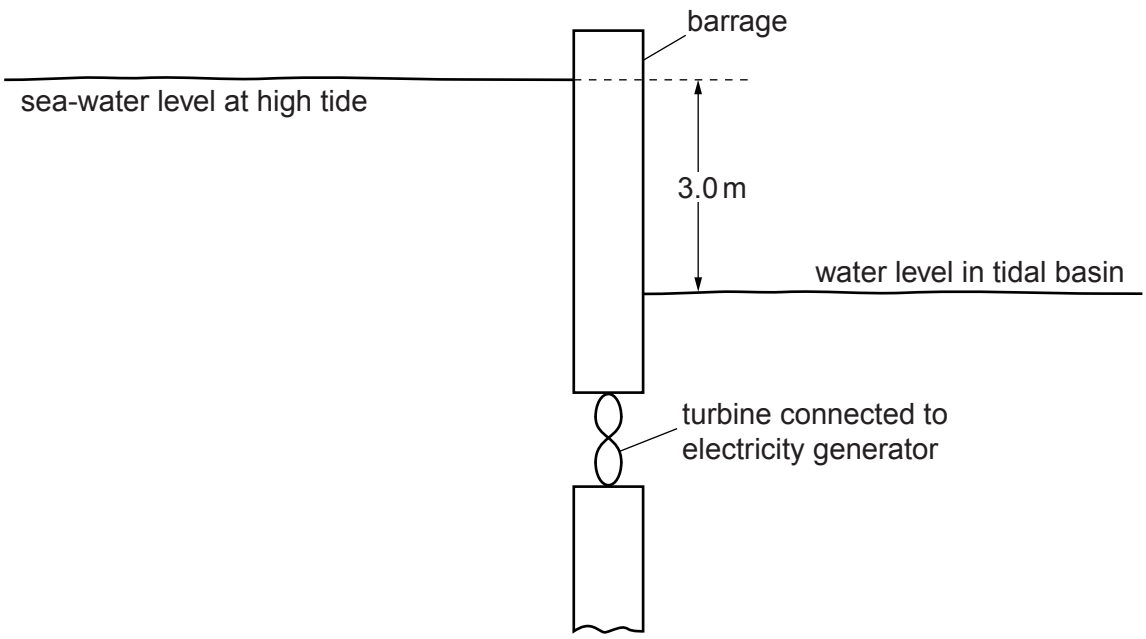

Fig. 3.1

At high tide, 1.0 m^3 of sea-water of density 1030 kg/m^3 flows through the turbine every second.

(a) Calculate the loss of gravitational potential energy when 1.0 m^3 of sea-water falls through a vertical distance of 3.0 m.

loss of gravitational potential energy = ... [3]

(b) Assume that your answer to **(a)** is the energy lost per second by the sea-water passing through the turbine at high tide. The generator delivers a current of 26 A at 400 V.

Calculate the efficiency of the scheme.

efficiency = ...% [3]

(c) At low tide, the sea-water level is lower than the water level in the tidal basin.

(i) State the direction of the flow of water through the turbine at low tide.

.....

(ii) Suggest an essential feature of the turbine and generator for electricity to be generated at low tide.

.....

.....

.....

[2]

[Total: 8]

2 An ornamental garden includes a small pond, which contains a pumped system that causes water to go up a pipe and then to run down a heap of rocks.

Fig. 3.1 shows a section through this water feature.

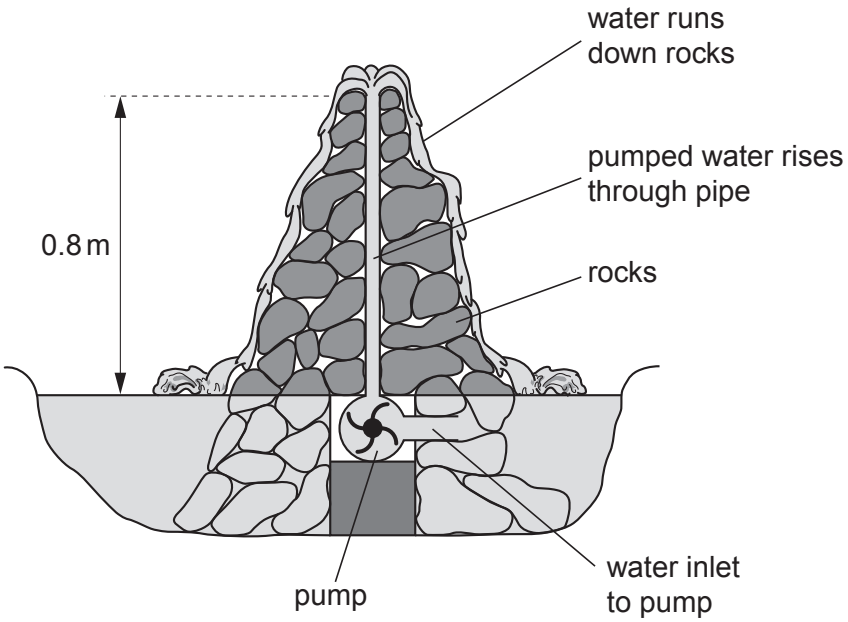

Fig. 3.1

The density of water is 1000 kg / m^3. A volume of 1 litre is equal to 0.001 m^3.

(a) Calculate the mass of 1 litre of water.

mass = ... [2]

(b) Calculate the work done raising 1 litre of water through a height of 0.8 m.

work = ... [2]

(c) The pump lifts 90 litres of water per minute.

Calculate the minimum power of the pump.

power = ... [2]

(d) The pump is switched off.

Immediately after the pump is switched off, what is the value of the water pressure at the bottom of the 0.8 m pipe, due to the water in the pipe?

pressure = ... [2]

[Total: 8]

3 The list below gives the approximate densities of various metals.

gold	19 g / cm^3
lead	11 g / cm^3
copper	9 g / cm^3
iron	8 g / cm^3

At an antiques market, a collector buys what is advertised as a small ancient gold statue. When the collector tests it in the laboratory, he finds its mass is 600 g and its volume is 65 cm^3.

(a) In the space below, describe how the volume of the statue could be measured. You may draw diagrams if you wish.

[3]

(b) Use the figures given above to decide whether the statue was really made of gold. Show your working.

Was the statue made of gold? (Tick one box.)

yes	
no	

[3]

[Total: 6]

4 Fig. 2.1 shows a reservoir that stores water.

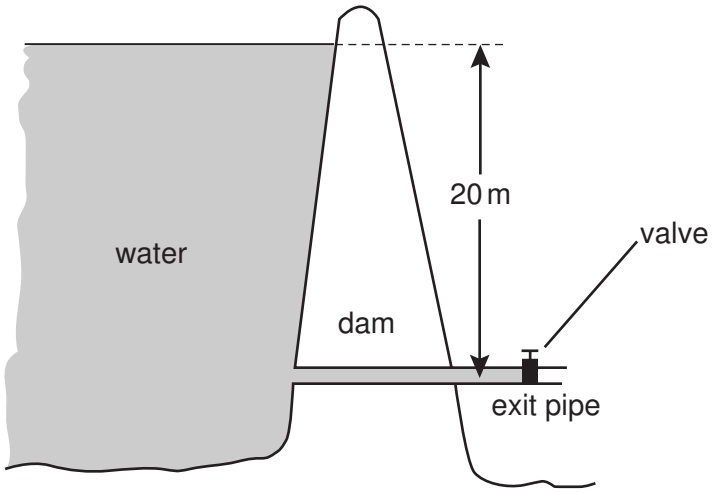

Fig. 2.1

(a) The valve in the exit pipe is closed. The density of water is 1000 kg/m^3 and the acceleration of free fall is 10 m/s^2.
Calculate the pressure of the water acting on the closed valve in the exit pipe.

pressure = ...[2]

(b) The cross-sectional area of the pipe is 0.5 m^2.
Calculate the force exerted by the water on the closed valve.

force = ...[2]

(c) The valve is then opened and water, originally at the surface of the reservoir, finally flows out of the exit pipe. State the energy transformation of this water between the surface of the reservoir and the open end of the pipe.

.....

.....[2]

[Total : 6]

1 **(a)** State an example of the conversion of chemical energy to another form of energy.

example .....

energy conversion .....[1]

(b) The electrical output of a solar panel powers a pump. The pump operates a water fountain. The output of the solar panel is 17 V and the current supplied to the pump is 0.27 A.

(i) Calculate the electrical power generated by the solar panel.

power = ... [2]

(ii) The pump converts electrical energy to kinetic energy of water with an efficiency of 35%.

Calculate the kinetic energy of the water delivered by the pump in 1 second.

kinetic energy = ... [2]

(iii) The pump propels 0.00014 m^3 of water per second. This water rises vertically as a jet. The density of water is 1000 kg/m^3.

Calculate

1. the mass of water propelled by the pump in 1 second,

mass = ... [2]

2. the maximum height of the jet of water.

maximum height = ... [2]

[Total: 9]

2 **(a)** A stone falls from the top of a building and hits the ground at a speed of 32 m/s.
The air resistance-force on the stone is very small and may be neglected.

(i) Calculate the time of fall.

time = ...

(ii) On Fig. 1.1, draw the speed-time graph for the falling stone.

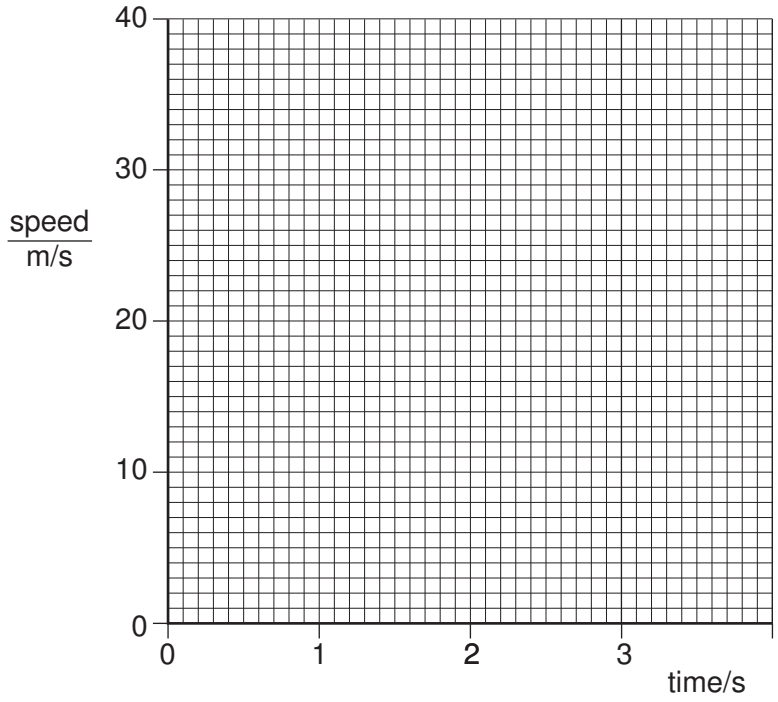

Fig. 1.1

(iii) The weight of the stone is 24 N.
Calculate the mass of the stone.

mass = ...
[5]

(b) A student used a suitable measuring cylinder and a spring balance to find the density of a sample of the stone.

(i) Describe how the measuring cylinder is used, and state the readings that are taken.

.....

.....

.....

.....

(ii) Describe how the spring balance is used, and state the reading that is taken.

.....

.....

(iii) Write down an equation from which the density of the stone is calculated.

.....

(iv) The student then wishes to find the density of cork. Suggest how the apparatus and the method would need to be changed.

.....

.....

.....

[6]

[Total : 12]

3 A scientist needs to find the density of a sample of rock whilst down a mine. He has only a spring balance, a measuring cylinder, some water and some thread.

(a) In the space below, draw two labelled diagrams, one to show the spring balance being used and the other to show the measuring cylinder being used with a suitable rock sample. [2]

(b) The spring balance is calibrated in newtons. State how the mass of the rock sample may be found from the reading of the spring balance.

.....[1]

(c) State the readings that would be taken from the measuring cylinder.

.....

.....[1]

(d) State how the volume of the rock would be found from the readings.

.....[1]

(e) State in words the formula that would be used to find the density of the sample.

density =

[1]

[Total : 6]

4 A student is given the following apparatus in order to find the density of a piece of rock.

100 g mass
metre rule
suitable pivot on which the rule will balance
measuring cylinder that is big enough for the piece of rock to fit inside
cotton
water

The rock has a mass of approximately 90 g.

(a) (i) In the space below, draw a labelled diagram of apparatus from this list set up so that the student is able to find the mass of the piece of rock.

(ii) State the readings the student should take and how these would be used to find the mass of the rock.

.....

.....

.....
[5]

(b) Describe how the volume of the rock could be found.

.....

.....

.....[2]

(c) The mass of the rock is 88 g and its volume is 24 cm^3.
Calculate the density of the rock.

density of rock = ... [2]