

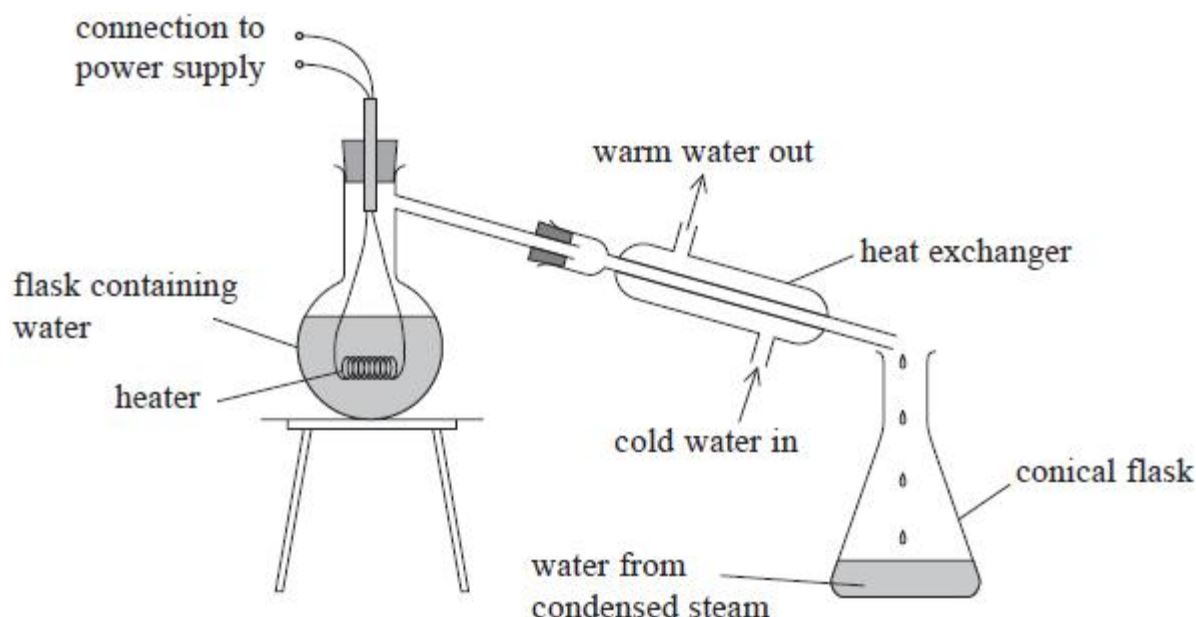
Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

The apparatus shown can be used to determine a value for the specific latent heat of vaporisation of water.



(a) In one experiment the current in the heater was 8.20 A, and the potential difference across the heater was 230 V.

(i) Show that the power of the heater was about 2 kW.

(2)

.....

(ii) There was 0.655 kg of water in the flask at an initial temperature of 22.5 °C.
 The heater was switched on, and the water in the flask was heated to boiling point.

Calculate the minimum time taken for the water to be heated to 100.0 °C.
 specific heat capacity of water = 4190 J kg⁻¹ K⁻¹

(3)

.....

Minimum time taken for water to be heated = ...

(b) The heater was left on and water continued to boil in the flask. The water was allowed to boil for a few

minutes. The conical flask was then placed under the heat exchanger and water was collected in it.

- (i) Give a reason why the water was left boiling for a few minutes before the conical flask was put in place. (1)

.....

.....

.....

.....

- (ii) Water with a mass of 95.0 g was collected in a time of 125 s.
Calculate the rate of energy transfer in the heat exchanger.
specific latent heat of vaporisation of water = $2.26 \times 10^6 \text{ J kg}^{-1}$

(3)

.....

.....

.....

.....

.....

Rate of energy transfer in the heat exchanger = ...

- (iii) Discuss your answers to (a)(i) and (b)(ii).

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 12 marks)

Q2.

Dolphins use ultrasound when hunting prey. They emit short pulses of ultrasound, known as clicks, and detect the ultrasound reflected from their prey.

- (a) Describe how ultrasound travels through water.

(2)

.....

.....

.....

.....

- (b) Suggest why the dolphins emit a series of clicks rather than a continuous sound.

(1)

.....

.....
.....
.....

(c) When searching for prey the dolphins emit 16 clicks per second.

(i) Show that the time between clicks when searching for prey is about 0.06 s.

(1)

.....
.....

(ii) Calculate the maximum distance that can be determined by the dolphin when searching for prey.

speed of sound in seawater = 1530 m s⁻¹

(3)

.....
.....
.....
.....
.....
.....

Maximum distance = ...

(iii) The dolphin increases the number of clicks per second to 125 when near to capturing its prey.

Suggest why.

(1)

.....
.....

(d) Bats use ultrasound in air when hunting prey. The ultrasound frequency and the duration of the click is the same for both bats and dolphins.

Explain whether bats or dolphins would be able to locate their prey more precisely.

speed of sound in air = 330 m s⁻¹

(3)

.....
.....
.....
.....
.....
.....

(Total for Question = 11 marks)