

Name of the Student: _____

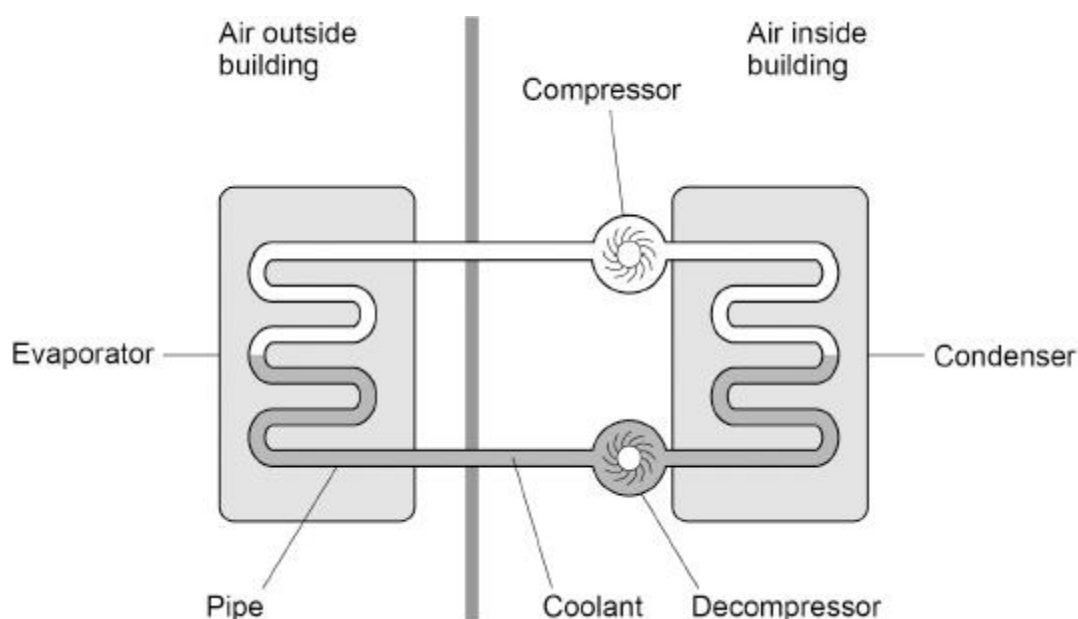
Max. Marks : 26 Marks

Time : 26 Minutes

Q1.

An air source heat pump transfers energy from the air outside a building to increase the temperature of the air inside the building.

The figure below shows an air source heat pump.



The compressor is connected to the mains electricity supply.

The pipe in the heat pump contains a substance called coolant.

In the evaporator, energy is transferred from the air outside the building to the liquid coolant.

The temperature of the coolant increases and it evaporates.

(a) Explain what happens to the internal energy of the coolant as its temperature increases.

(2)

(b) What name is given to the energy needed to change the state of the liquid coolant?

- (c) What happens to the mass of the coolant as it evaporates and becomes a vapour?

Tick (✓) **one** box.

Decreases

☐

Stays the same

☐

Increases

☐

(1)

- (d) The compressor increases the density and temperature of the coolant vapour inside the pipe.

Explain why the pressure in the pipe increases.

(2)

- (e) The condenser transfers energy from the coolant to the air in the building.

When the total energy input to the heat pump system is 1560 kJ the temperature of the air in the building increases from 11.6 °C to 22.1 °C.

The efficiency of the heat pump system is 87.5%.

The mass of the air inside the building is 125 kg.

Calculate the specific heat capacity of the air in the building.

Give your answer in standard form.

Specific heat capacity (standard form) = _____ J/kg °C

(6)

- (f) The air in the building gains 400 J for every 100 J of energy transferred from the mains electricity supply to the compressor.

An advertisement claims that the heat pump system has an efficiency of 400%.

Explain why the advertisement is **not** correct.

(3)

(Total 15 marks)

Q2.

A student made water waves in a ripple tank.

- (a) Describe how the frequency and wavelength of the water waves in the ripple tank can be measured accurately.

(4)

The student recorded values for the frequency and the wavelength of waves in the ripple tank.

Table 1 and **Table 2** show the results.

Table 1

Reading	1	2	3
---------	---	---	---

Frequency in hertz	9.8	9.4	9.3
---------------------------	-----	-----	-----

Table 2

Reading	1	2	3
Wavelength in cm	1.7	2.2	2.1

- (b) Determine the mean wave speed.

Mean wave speed = _____ m/s

(4)

- (c) What is the advantage of taking repeat readings and then calculating a mean?

(1)

- (d) The speed of the wave is affected by the depth of the water in the ripple tank.

The deeper the water the faster the wave.

Explain how the depth of the water affects the wavelength of the wave if the frequency is constant.

(2)

(Total 11 marks)