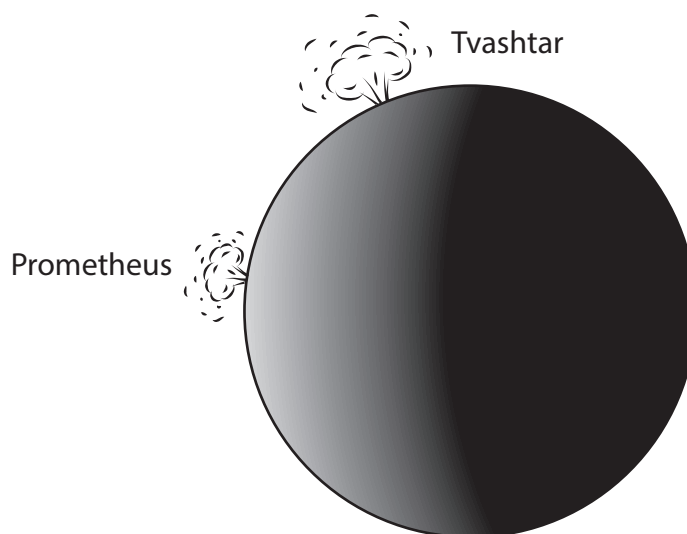


7 This is a question about Io, a moon of Jupiter.

The diagram shows two jets of gas from volcanoes on Io.

One jet of gas is from the volcano Prometheus and the other is from the volcano Tvashtar.



- (a) Gas particles in the Prometheus jet leave the surface of Io and move vertically upwards.

The particles reach their maximum height when their speed is zero.

Some particles in the Prometheus jet reach a maximum height of 92 km.

Calculate the initial speed of these particles as they leave the surface of Io.

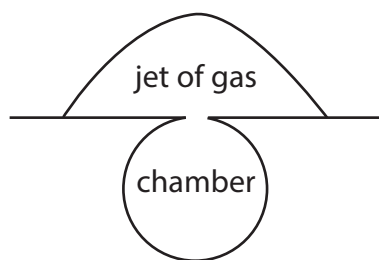
[acceleration due to gravity on Io = 1.8 m/s^2]

(3)

initial speed = m/s



(b) Before the gas particles leave the surface of Io, they are trapped in a chamber.



(i) Explain how the gas particles exert a pressure on the walls of the chamber.

(3)

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(ii) The Tvashtar chamber has the same volume as the Prometheus chamber and contains the same number of molecules of the same type of gas.

The temperature of the gas in the Prometheus chamber is 1200 K.

The temperature of the gas in the Tvashtar chamber is 1600 K.

The pressure of the gas in the Prometheus chamber is 8.2 kPa.

Calculate the pressure of the gas in the Tvashtar chamber.

(3)

pressure = kPa



- (iii) Explain why the pressure inside the chambers increases when the temperature increases.

Use ideas about particles in your answer.

(3)

- (iv) Explain why the particles from the Tvashtar chamber reach a greater maximum height than the particles from the Prometheus chamber.

(3)

(Total for Question 7 = 15 marks)



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