1) The lowest atmospheric pressure ever measured on Earth was 87.0 kPa. This pressure was measured with a barometer at sea level in the eye of Typhoon Tip in October 1979.

a) What is the value of this low pressure in mm Hg?
b) What is the value of this low pressure in atm's?

a) P_{atm}: 101.3 kPa = 760mm Hg
87.0 kPa = x

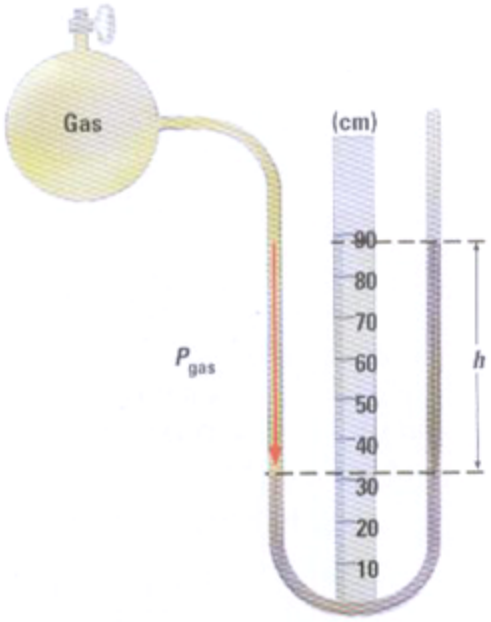
x = 652.7 mm Hg

b) P_{atm}: 101.3 kPa = 1 atm
87.0 kPa = x

x = 0.85 atm

2) What gas pressures do the following mercury manometers indicate:

a)



Closed-End Manometer

P_{gas} = h

height = 88cm of Hg - 32cm of Hg

height = 56cm of Hg

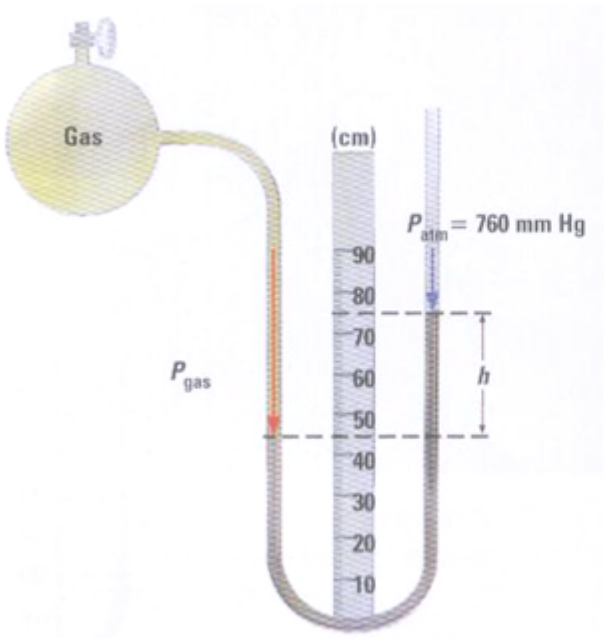
height = 560mm of Hg

P_{gas} = h

P_{gas} = 560mm of Hg

2) What gas pressures do the following mercury manometers indicate:

b)



Open-End Manometer

$$P_{gas} > P_{atm}$$

$$P_{gas} = P_{atm} + h$$

height = 75cm of Hg - 45cm of Hg

height = 30cm of Hg

height = 300mm of Hg

$P_{gas} = P_{atm} + h$

$P_{gas} = 760mm\ Hg + 300mm\ Hg$

$P_{gas} = 1060mm\ of\ Hg$

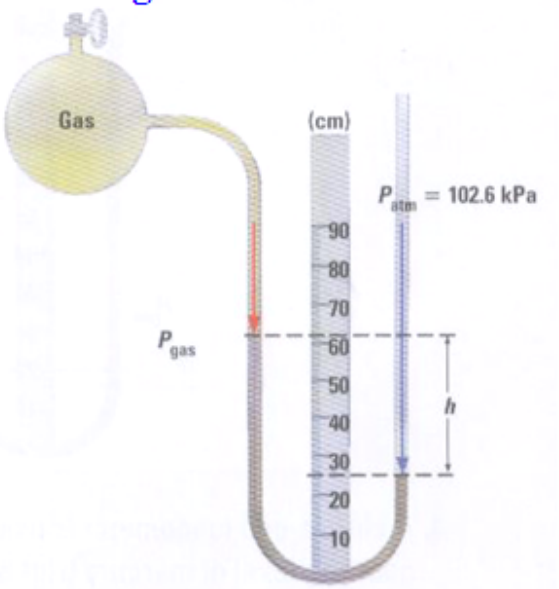
2) What gas pressures do the following mercury manometers indicate:

c)

Open-End Manometer

$$P_{gas} < P_{atm}$$

$$P_{gas} = P_{atm} - h$$



height = 62cm of Hg - 25cm of Hg

height = 37cm of Hg

height = 370mm of Hg

P_{atm}: 101.3 kPa = 760mm Hg

102.6 kPa = x

x = P_{atm} = 769.8 mm Hg

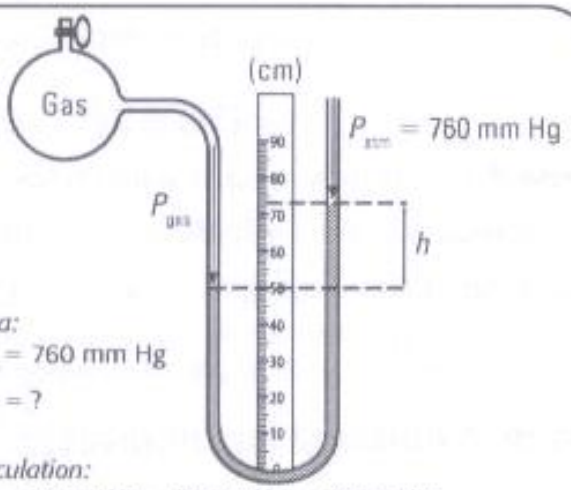
$P_{gas} = P_{atm} - h$

$P_{gas} = 769.8mm\ Hg - 370mm\ Hg$

$P_{gas} = 399.8mm\ of\ Hg$

Exercises: Solve

a)

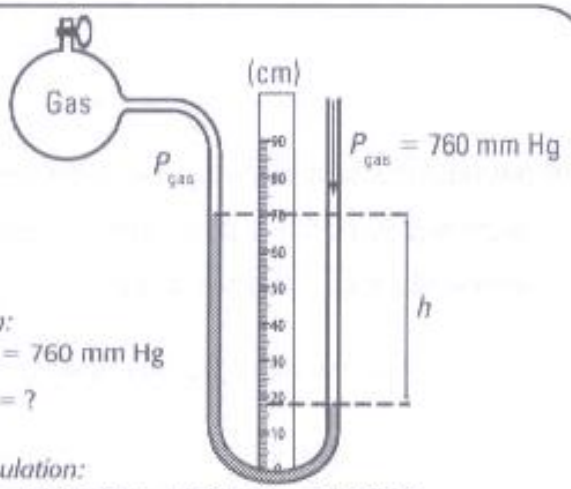


Data:
P_{atm} = 760 mm Hg
P_{gas} = ?

Calculation:
h = 73 cm Hg − 50 cm Hg = 23 cm Hg
= 230 mm Hg
$P_{gas} = P_{atm} + h$
= 760 mm Hg + 230 mm Hg = 990 mm Hg

Answer: 990 mm Hg

c)

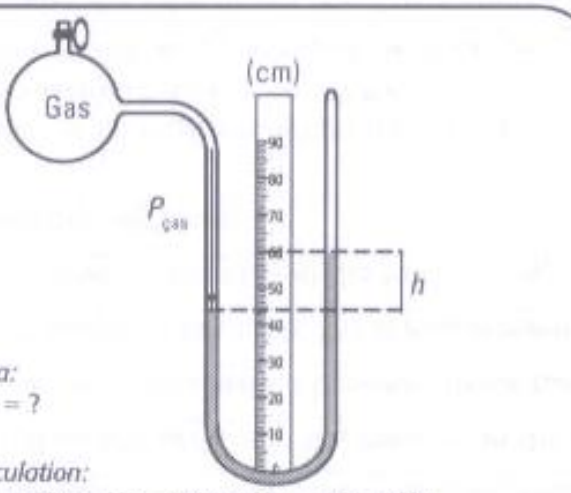


Data:
P_{atm} = 760 mm Hg
P_{gas} = ?

Calculation:
h = 70 cm Hg − 18 cm Hg = 52 cm Hg
= 520 mm Hg
$P_{gas} = P_{atm} - h$
= 760 mm Hg − 520 mm Hg = 240 mm Hg

Answer: 240 mm Hg

b)

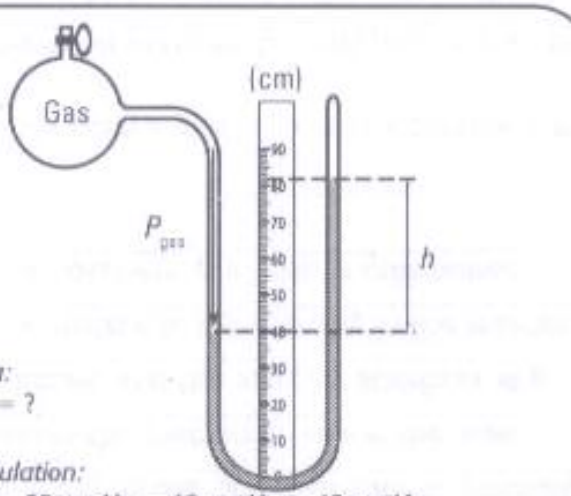


Data:
P_{gas} = ?

Calculation:
h = 60 cm Hg − 44 cm Hg = 16 cm Hg
= 160 mm Hg
$P_{gas} = h$
= 160 mm Hg

Answer: 160 mm Hg

d)



Data:
P_{gas} = ?

Calculation:
h = 82 cm Hg − 40 cm Hg = 42 cm Hg
= 420 mm Hg
$P_{gas} = h$
= 420 mm Hg

Answer: 420 mm Hg

P.74

1. The particles of a gas continually collide with each other and with the walls of their container. The collisions exert a force that pushes against the inner surface in all directions.

2. *In atmospheres:*

$$\frac{760 \text{ mm Hg}}{1 \text{ atm}} = \frac{688 \text{ mm Hg}}{?}$$

$$? = 688 \cancel{\text{mm Hg}} \cdot \frac{1 \text{ atm}}{760 \cancel{\text{mm Hg}}} = 0.905 \text{ atm}$$

In kilopascals:

$$\frac{760 \text{ mm Hg}}{101.3 \text{ kPa}} = \frac{688 \text{ mm Hg}}{?}$$

$$? = 688 \cancel{\text{mm Hg}} \cdot \frac{101.3 \text{ kPa}}{760 \cancel{\text{mm Hg}}} = 91.7 \text{ kPa}$$

Answer: A pressure of 688 mm Hg corresponds to 0.905 atm and 91.7 kPa.

3. a) *1. Calculation of the height:*

$$h = 65.0 \text{ cm Hg} - 20.0 \text{ cm Hg}$$
$$= 45.0 \text{ cm Hg} = 450 \text{ mm Hg}$$

2. Calculation of the pressure:

$$P_{gas} = h$$
$$= 450 \text{ mm Hg}$$

Answer: The pressure of the gas in the container of the manometer is 450 mm Hg.

b) The pressure of the gas in the container of the manometer is 99.9 kPa.

Calculation of the atmospheric pressure:

$$\frac{760 \text{ mm Hg}}{101.3 \text{ kPa}} = \frac{?}{99.9 \text{ kPa}}$$

$$? = 99.9 \cancel{\text{kPa}} \cdot \frac{760 \text{ mm Hg}}{101.3 \cancel{\text{kPa}}} = 749.5 \text{ mm Hg}$$

Answer: The pressure of the gas in the container of the manometer is 750 mm Hg.

3. c) *1. Calculation of the height:*

$$h = 65.0 \text{ cm Hg} - 20.0 \text{ cm Hg}$$
$$= 45.0 \text{ cm Hg} = 450 \text{ mm Hg}$$

2. Calculation of the pressure:

$$\frac{760 \text{ mm Hg}}{101.3 \text{ kPa}} = \frac{?}{99.9 \text{ kPa}}$$

$$? = 99.9 \cancel{\text{kPa}} \cdot \frac{760 \text{ mm Hg}}{101.3 \cancel{\text{kPa}}} = 749.5 \text{ mm Hg}$$

$$P_{gaz} = P_{atm} + h$$
$$= 749.5 \text{ mm Hg} + 450 \text{ mm Hg}$$
$$= 1199.5 \text{ mm Hg}$$

Answer: The pressure of the gas in the container of the manometer is 1.2×10^3 mm Hg.

d) *1. Calculation of the height:*

$$h = 65.0 \text{ cm Hg} - 20.0 \text{ cm Hg}$$
$$= 45.0 \text{ cm Hg} = 450 \text{ mm Hg}$$

2. Calculation of the pressure:

$$\frac{760 \text{ mm Hg}}{101.3 \text{ kPa}} = \frac{?}{99.9 \text{ kPa}}$$

$$? = 99.9 \cancel{\text{kPa}} \cdot \frac{760 \text{ mm Hg}}{101.3 \cancel{\text{kPa}}} = 749.5 \text{ mm Hg}$$

$$P_{gaz} = P_{atm} - h$$
$$= 749.5 \text{ mm Hg} - 450 \text{ mm Hg}$$
$$= 299.5 \text{ mm Hg}$$

Answer: The pressure of the gas in the container of the manometer is 300 mm Hg.

4. *1. Calculation of the atmospheric pressure:*

$$\frac{760\ \text{mm Hg}}{101.3\ \text{kPa}} = \frac{?}{99.7\ \text{kPa}}$$

$$? = 99.7\ \cancel{\text{kPa}} \cdot \frac{760\ \text{mm Hg}}{101.3\ \cancel{\text{kPa}}} = 748.0\ \text{mm Hg}$$

2. Calculation of the pressure of the gas:

$$P_{\text{gas}} = P_{\text{atm}} - h$$

$$= 748.0\ \text{mm Hg} - 18\ \text{mm Hg}$$

$$= 730.0\ \text{mm Hg}$$

$$\frac{760\ \text{mm Hg}}{101.3\ \text{kPa}} = \frac{730.0\ \text{mm Hg}}{?}$$

$$? = 730.0\ \cancel{\text{mm Hg}} \cdot \frac{101.3\ \text{kPa}}{760\ \cancel{\text{mm Hg}}} = 97.3\ \text{kPa}$$

Answer: The pressure of the gas in the container of the manometer is 97.3 kPa.