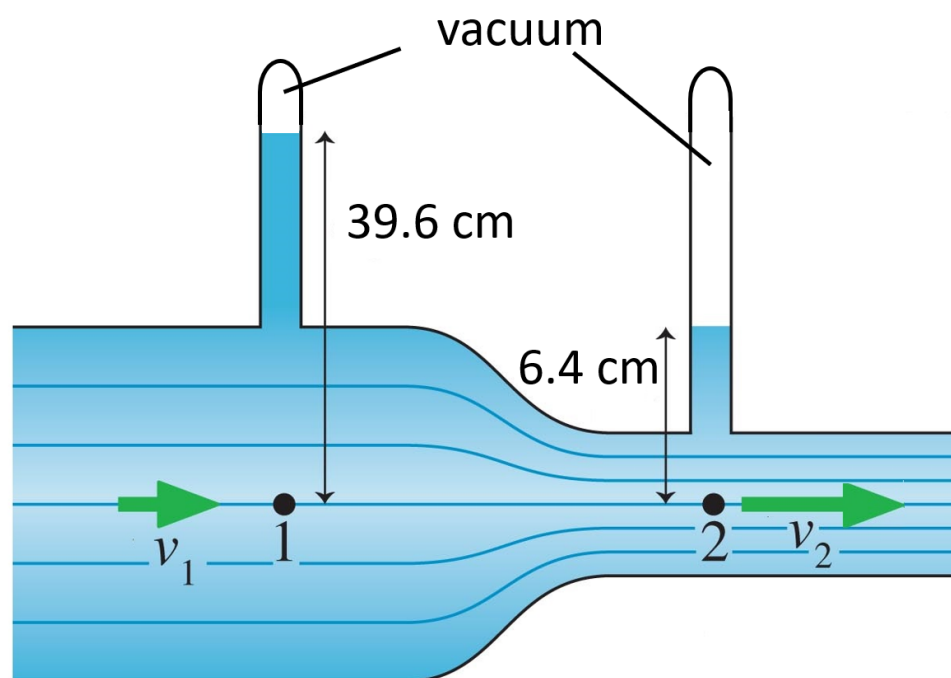## Q1 MC 1
2 Points

The figure shows a section of the venturi device with glycerin flowing inside. If the area in region 1 is double that of region 2, what is the speed v_2? $\rho_{glycerin} = 1260\ kg/m^3$.

vacuum

39.6 cm

6.4 cm

v_1 1   2 v_2

- ⦿ 2.95 m/s
- ○ 1.47 m/s
- ○ 2.55 m/s
- ○ 36.1 m/s
- ○ 3.61 m/s

Q2 MC 2
2 Points

A spring has an unstretched length of 40 cm. When a 100 gram mass hanging from the spring, it stretches the spring 10 cm. Suppose the mass is pulled down to where the spring's length is 65 cm. When the

mass oscillate back to the unstretched length of 40 cm the first time, the velocity and the spring force is: (take upward direction positive)

⦿ v_y is + and F_y is 0

◯ v_y is + and F_y is +

◯ v_y is + and F_y is -

◯ v_y is 0 and F_y is -

◯ v_y is 0 and F_y is 0

Q3 MC 3
2 Points

Which of the following combinations of variables results in the greatest period for a pendulum ?

◯ Length = L, mass = M, and maximum angular displacement = 3 degrees

⦿ Length = 2L, mass = M/2, and maximum angular displacement = 1 degrees

◯ Length = 1.5L, mass = 2M, and maximum angular displacement = 2 degrees

◯ Length = √2L, mass = √2M, and maximum angular displacement = √2 degrees

◯ Length = √3L, mass = 4M, and maximum angular displacement = 4 degrees

Q4 MC 4
2 Points

In a straight pipe of uniform cross-sectional area filled with a nonviscous, incompressible fluid, the pressure of one end is equal to the pressure at the other end. Which of the following statements is/are true?

I.   The volume flow rate is zero because there is no net force on the

fluid.

II.   The volume flow rate is constant throughout the pipe because the cross-sectional area is uniform.
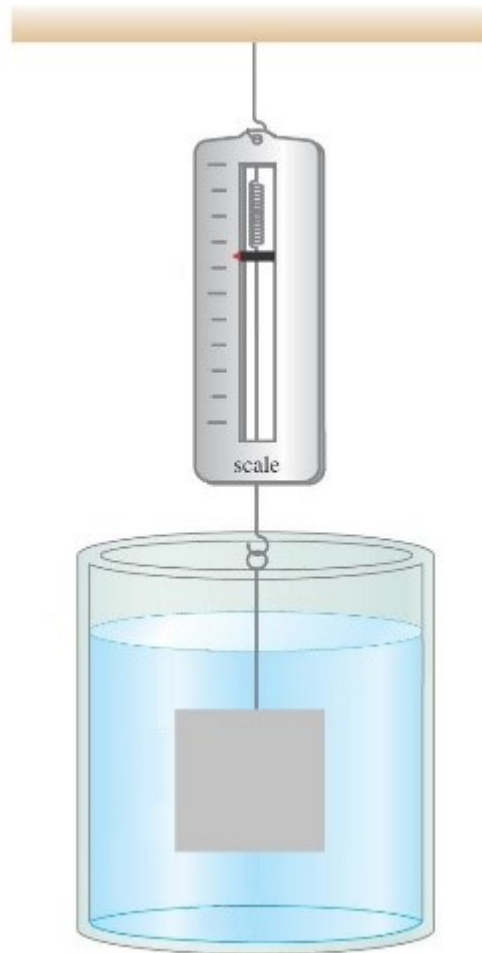
III.   The pipe is not inclined relative to the horizontal since the pressure is constant.

○ II only

○ I and III only

◉ II and III only

○ I, II, and III

Q5 MC 5
2 Points

When a block of volume $1.00 \times 10^{-3} m^3$ is fully submerged in a tank fill with liquid with specific gravity of 1.5. The block is hung from a spring scale as shown, the scale reads 5.1 N. What is the mass of the block?

O 1.02 kg

O 3.12 kg

O 1.08 kg

⊙ 2.02 kg

O 10.6 kg

Q6 Prob 1
20 Points

Annie plans to use an injector syringe as shown to decorate the cake top with cream. Assume she holds the syringe horizontally at all time. The cream flows out of the needle at $3.05 \times 10^{-6} \ cm^3/s$. The viscosity of the cream is 0.112 Pa·s .

Answer in 3 significant figures (Show your work)

Inner diameter of tube: 1.4 cm

Inner diameter of needle:0.2 cm

P

15 cm   10 cm
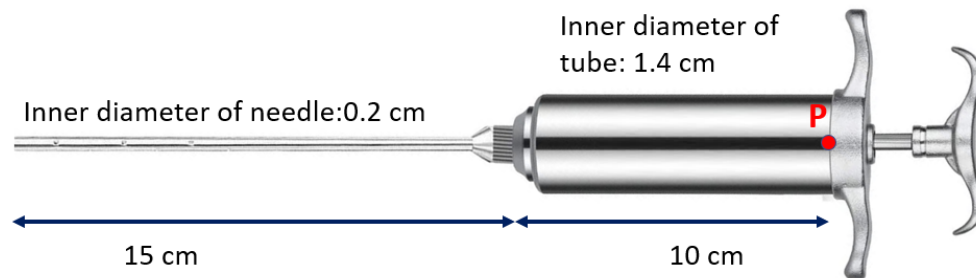
Q6.1 Prob 1a
13 Points

What is the gauge pressure at point P (inside the tube)?

Answer in 3 significant figures

0.131 Pa

Q6.2 Prob 1b
7 Points

If the opening at the needle tip is 1.0 atm, what force Annie needs to apply to the syringe ?

Answer in 3 significant figures

2.01*10^-5 N

Upload your work for the whole problem:

▼ IMG_0014.jpg   ⬇ Download

Short Answer 1

$Q_2 = 3.05 \times 10^{-6} \ cm^3/s$ $\qquad$ $n = 0.112 \ Pa \cdot s$

$Q_2 = Av$

$r_2 = 0.1 \ cm$

$A_2 v_2 = A_1 v_1$

$\pi (0.1)^2 \cdot (9.708 \times 10^{-5}) = \pi (0.7)^2 v_1$

$A = \pi r^2$

$v_1 = 1.8512 \times 10^{-6} \ cm/s$

$A_2 = \pi (0.1 \ cm)^2$

convert

$3.05 \times 10^{-6} = (\pi (0.1)^2) v_2$

$v_1 = 1.8512 \times 10^{-8} \ cm/s$

$v_2 = 9.708 \times 10^{-5} \ cm/s$

$v_2 = 9.708 \times 10^{-7} \ m/s$

$\Delta P = 8 \pi n \dfrac{L \, v_{avg}}{A} + 8 \pi n \dfrac{L \, v_{avg}}{A}$

$= 8 \pi (0.112) \left[\dfrac{0.15 \cdot}{\pi (0.001)^2} + \dfrac{0.1 \cdot}{\pi (0.007)^2} \right]$

a)

$\boxed{\Delta P = 0.13051 \ Pa}$

$P = \dfrac{F}{A}$

$\dfrac{F's}{\pi (0.007)^2} = 0.13051$

$F = 2.01 \times 10^{-5} \ N$

$F > 1 \ atm$

$P = \dfrac{F}{A}$

$1 \ atm = \dfrac{F}{A}$

$101325 = \dfrac{F}{\pi (0.001)^2}$

$F = 3.225 \times 10^{10} \ N$

Q7 Prob 2

25 Points

The following shows the velocity-versus-time graph of a 0.25 kg particle moving along the x axis in SHM. The particle has a maximum speed of 8.0 cm/s. At t = 0 s the particle is moving towards equilibrium.

Velocity vs. time
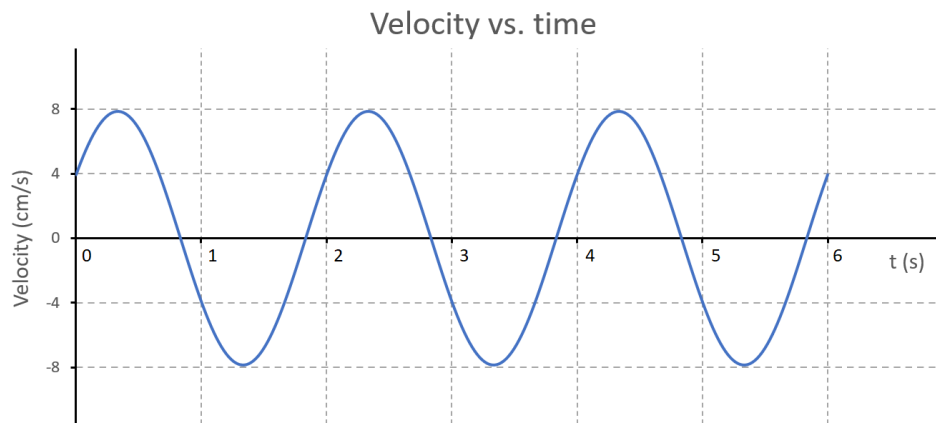
Answer in 3 significant figures (Show your work)

Q7.1 Prob 2a
5 Points

Determine the oscillation amplitude A .

Answer in 3 significant figures

2.55 cm

Q7.2 Prob 2b
7 Points

Determine the initial position x_0 at t = 0 s .

Answer in 3 significant figures

2.21 cm

Q7.3 Prob 2c
8 Points

Let $x(t) = A cos(\omega t + \phi_0)$, find the in itial phase angle ϕ_0.

Answer in 3 significant figures

0.522 rad

Q7.4 Prob 2d
5 Points

What is the total distance traveled between t = 1.0 s and 2.5 s.

Answer in 3 significant figures

1.62 cm

Upload your work for the whole problem:

▼ IMG_0013.jpg   ⬇ Download

Short Answer 2

$v_{max} = 8.0 \text{ cm/s}$

$v_{max} = \omega A$

$\omega = 2\pi\left(\frac{1}{T}\right)$

$T = 2s$ based on graph

a) $8.0 \text{ cm/s} = 2\pi\left(\frac{1}{2s}\right) A$

$A = 2.5465$

b) $A^2 = x_0^2 + \left(v_0/\omega\right)^2$

$2.55^2 = x_0^2 + \left(\frac{4 \text{ cm/s}}{2\pi\left(\frac{1}{2s}\right)}\right)^2$

$x_0 = 2.20938$

$x(t) = A\cos(\omega t + \phi_0)$

$x(0) = 2.55\cos\left(2\pi\left(\frac{1}{2}\right)(0) + \phi_0\right)$

$2.21 = 2.55\cos(\phi_0)$
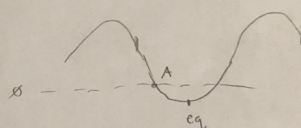
$\arccos\left(\frac{2.21}{2.55}\right) = \phi_0$

c) $\phi_0 = 0.522$

d) $x(1) = 2.55\cos\left(2\pi\left(\frac{1}{2}\right) + 0.522\right)$

$x(1) = -2.21$

$x(2.5) = 2.55\cos\left(\pi \overset{\times 2.5}{\downarrow} + 0.522\right)$

$x(2.5) = -1.27$

$-A$

$-2.21 \rightarrow -2.55 \rightarrow -1.27$

$0.34 \qquad 1.28$

1.62 cm traveled

Midterm (2021 C)   ● GRADED

STUDENT

CHRISTINA KILKEARY

TOTAL POINTS

47.5 / 55 pts

QUESTION 1

MC 1   **2** / 2 pts

QUESTION 2

MC 2   **2** / 2 pts

QUESTION 3

MC 3   **2** / 2 pts

QUESTION 4

MC 4   **2** / 2 pts

QUESTION 5

MC 5   **2** / 2 pts

QUESTION 6

Prob 1   **18** / 20 pts

| 6.1 | Prob 1a | **13** / 13 pts |
| 6.2 | Prob 1b | **5** / 7 pts |

QUESTION 7

Prob 2   **19.5** / 25 pts

7.1	Prob 2a	**5** / 5 pts
7.2	Prob 2b	**5** / 7 pts
7.3	Prob 2c	**6** / 8 pts
7.4	Prob 2d	**3.5** / 5 pts