LAST NAME: **STUDENT # :**

FIRST LETTER OF LAST NAME: **FIRST NAME:**

Phys. 101 Section 103 Mid-term exam.
Thurs. Oct. 23 2003. Hebb Theatre 11:00 am – 12:20 pm
Instructor : J. E. Eldridge

ANSWER ALL 4 QUESTIONS. PART MARKS ARE SHOWN IN THE MARGIN.

Question	#1	#2	#3	#4	TOTAL
Mark					

Part marks

Question 1. A spherically-shaped balloon has a radius of 8.0 m and is filled with helium. (Density of air is 1.29 kg/m^3 and that of helium is 0.179 kg/m^3)

5 a) What is the buoyancy mass (force/g) acting on the balloon ?

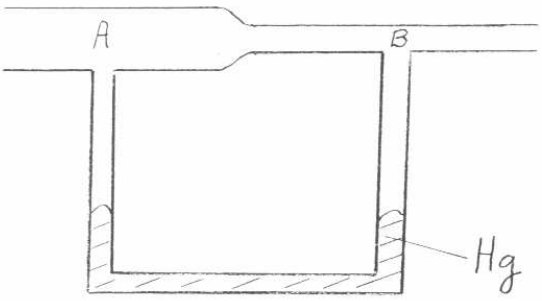
2767 kg

15 b) How large a cargo can it lift, assuming that the skin and structure of the balloon have a mass of 1000 kg ? Neglect the buoyancy force of the cargo itself.

1383 kg

20

Question 2.



A glass tube is set up as shown on the left, with a mercury manometer attached at points A and B. The tube is circular with the diameter at A twice that at B. A flow of water, from A to B, is then started.

2 a) Does the mercury at point B rise or fall ?

Rise

5 b) If the velocity of the water at A is 0.5 m/s, what is it at point B ?

2 m/s

10 c) If the gauge pressure at point A is 20 kPa, what is it at point B ?

18,125 Pa

7 d) How high does the mercury column rise on one side of the manometer (S.G. of Hg is 13.6)

7 mm

6 e) Assuming the tube to be very long, how high would the end B have to be lifted in order to stop the flow of water ?

2.04 m

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Question 3 The position of a simple harmonic oscillator as a function of time is given by **$x = 3.8 \cos (7\pi t / 4 + \pi / 6)$,** where t is in seconds and x in metres.

2 a) Find the angular frequency. $7\pi/4$ rad/s

2 b) Find the frequency $7/8$ Hz

2 c) Find the period $8/7$ sec

3 d) Find the ~~wavevector~~ phase angle in degrees 30°

3 e) Find the position at t = 0

3.29 m

3 f) Find the velocity at t = 0

-10.44 m/s

3 g) Find the velocity at t = 2.0 secs.

$+18.08$ m/s

3 h) Find the acceleration at t = 2.0 secs

-57.4 m/s^2

4 i) Find the energy of the system if the mass of the oscillator is 3 kg.

655 J

25

Question 4 A 450 gram object oscillates from a vertically hanging light spring once every 0.55 secs.

5 a) Write the equation giving its position y (+ is upward) as a function of time t, assuming it started by being compressed 10 cm from the equilibrium position (where y = 0), and released.

$y = 10\text{ cm}\ \cos 11.42t$

5 b) How long will it take to get to the equilibrium position for the first time ?

0.1375 sec

5 c) What will be its maximum speed ?

1.14 m/s

5 d) What will be its maximum acceleration, and where will it first be attained ?

13.04 m/s^2

5 e) At which single position will the spring potential energy be the greatest. Explain.

At bottom of oscillation

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