23S-PHYSICS-1B-LEC-3 Midterm2_typeB

SANJIT SARDA

TOTAL POINTS

32 / 40

QUESTION 1

1 MCQ1 2 / 2

✓ **- 0 pts** *Correct*

- 2 pts Incorrect

QUESTION 2

2 MCQ2 0 / 2

- 0 pts Correct

✓ **- 2 pts** *Incorrect*

QUESTION 3

3 MCQ3 0 / 2

- 0 pts Correct

✓ **- 2 pts** *Incorrect*

QUESTION 4

4 MCQ4 0 / 2

- 0 pts Correct

✓ **- 2 pts** *Incorrect*

QUESTION 5

5 MCQ5 0 / 2

- 0 pts Correct

✓ **- 2 pts** *Incorrect*

- 2 pts Blank

QUESTION 6

6 2.1A 4 / 4

✓ **+ 4 pts** *Correct answer with appropriate units.*

+ 3 pts Successfully able to identify the right numeric values into the the total energy equation but did not mention the units or minor calculation error towards the end that led to a different answer.

+ 1.5 pts Defined the total energy of the system in terms of a summation of kinetic and potential energy E = 1/2KX^2+1/2MV^2. Able to identify the the position of the block and corresponding speed.

+ 0 pts inconsiderable attempt that included implementation of wrong formula

QUESTION 7

7 2.1B 3 / 3

✓ **+ 3 pts** *Correct answer with appropriate units.*

+ 2 pts Successfully able to identify the right numeric values into the the equation but did not mention the units or minor calculation error towards the end that led to a different answer.

+ 1 pts Able to identify the right formula E=1/2kA^2 and re write it in terms of A.

+ 0 pts inconsiderable answer

QUESTION 8

8 2.1C 3 / 3

✓ **+ 3 pts** *Correct answer with appropriate units.*

+ 2 pts Successfully able to identify the right

numeric values into the the equation but did not mention the units or minor calculation error towards the end that led to a different answer. Managed to determine that V will be maximum when X=0.

+ 1 pts Able to identify the right formula E=1/2mVmax^2 and re write it in terms of Vmax.

+ 0.5 pts inconsiderable attempt wrong formula

+ 0 pts No attempt

+ 0 pts If the answer is on the back please find the physical copy and send the TAs a picture of your working. To check the physical copies contact professor.

QUESTION 9

9 2.2A **3 / 3**

✓ **+ 3 pts** *Correct*

+ 2 pts Correct $$\beta = 90dB = 10dB \cdot log_{10}(\frac{I}{I_0}) $$

+ 1 pts Effort

QUESTION 10

10 2.2B **4 / 4**

✓ **+ 4 pts** *Correct*

+ 4 pts Error Carried Forward

+ 2 pts Correct $$p_{max} = \sqrt{2 \rho v I}$$

+ 1 pts Effort

+ 0 pts No answer

QUESTION 11

11 2.2C **3 / 3**

✓ **+ 3 pts** *Correct*

+ 1 pts Correct $$\frac{I_1}{I_2} = (\frac{r_2}{r_1})^2$$

+ 1 pts Correct $$\frac{I_1}{I_2} = 10^3$$

+ 1 pts Effort

+ 0 pts No answer

QUESTION 12

12 2.3A **2 / 2**

✓ **- 0 pts** *2000IQ Big Brain*

- 0.5 pts Calculator Malfunction?

- 1 pts Used $$v=f\lambda$$ instead, the formula itself is correct but you were not given $$\lambda$$ so this is not the right approach~

- 1.5 pts You tried and I appreciate that so here is half a point

QUESTION 13

13 2.3B **2 / 2**

✓ **- 0 pts** *UNIVERSAL BASIC INCOME*

QUESTION 14

14 2.3C **2 / 2**

✓ **- 0 pts** *EINSTEIN*

- 0.5 pts Calculator Malfunction

- 0 pts found $$1/\lambda$$ instead of $$k=2\pi/\lambda$$

- 1 pts Found $$\lambda$$ but not $$k$$

- 1 pts Correct formula but wrong numbers used for formula

- 1.5 pts did not understand what a wavenumber was and tried to find some kind of fundamental frequency mode

- 1.5 pts Other incorrect approach or no attempt

QUESTION 15

15 2.3D **4 / 4**

✓ **- 0 pts** *What an absolute baller*

- **0.5 pts** Calculator malfunction
- **1 pts** Simple careless calculation error~
- **1 pts** Forgot to multiply f by $$2\pi$$
- **2 pts** $$\omega^2 = k/m$$ applies to a SPRING, where the SPRING CONSTANT is $$k$$. $$\omega^2 = g/l$$ applies to a PENDULUM. Here we are using the *wavenumber* $$k$$, which is an entirely different quantity. I see you mixed up these two quantities.
- **2 pts** Made some significant mistake in applying the formula, for example, mistaking F for frequency instead of tension, or mistaking v for the transverse velocity, or using a different omega entirely
- **3 pts** Entirely incorrect approach or lack of attempt
- **3 pts** wrote on back of page, PLEASE NOTE YOUR NAME DOWN HERE: https://docs.google.com/document/d/1S6xakRU4Sm6MlWnhluv6arNgIO7O1AEAlyaqlYhYUAM/edit?usp=sharing

gradescope

Name: Sanjit Sarda

Student ID #: 805964031

Signature: Sanjit Sarda

May 1, 2023

Physics 1B Midterm Exam #2, version B

- You have 50 minutes to complete this exam. You MUST close the exam and hand it in at the front when time is up. Show your student ID when handing in your exam. If we have to come collect your exam from your row, your exam will be marked so that 25% will be immediately deducted.
- Numerical values in answers: quote values with 3 significant figures, for example, 0.262 or 3.72×10^3. Express your answers in SI units unless indicated otherwise.
- Exam rules:
  - The last sheet of the exam is an equation sheet that should be torn off. It can be thrown away after the exam. Fit all relevant calculations on the front of the pages.
  - You can use any type of calculator that does not have internet capability. Silence and put away your cell phones and laptops.
  - If you have questions during the exam, raise your hand. If you are not seated near the end of a row, you may need to come to the aisle or down to the front of the room to ask them.
  - You MUST sign and date the 2nd page entitled "Academic Integrity – A Bruin's Code of Conduct" in order to receive credit for your work.
- Remember to write down each step of your calculation, and explain your answers fully.

Score :

I.1-5	(Multiple choice)	_____/10 points
II.1		_____/10 points
II.2		_____/10 points
II.3		_____/10 points
	Total score	_____/40 points

Academic Integrity - A Bruin's Code of Conduct:

UCLA is a community of scholars committed to the values of integrity. In this community, all members including faculty, staff, and students alike are responsible for maintaining the highest standards of academic honesty and quality of academic work. As a student and member of the UCLA community, you are expected to demonstrate integrity in all of your academic endeavors. When accusations of academic dishonesty occur, the Office of the Dean of Students investigates and adjudicates suspected violations of this student code. Unacceptable behavior include cheating, fabrication or falsification, plagiarism, multiple submissions without instructor permission, using unauthorized study aids, facilitating academic misconduct, coercion regarding grading or evaluation of coursework, or collaboration not authorized by the instructor. Please review our campus' policy on academic integrity in the UCLA Student Conduct Code: https://deanofstudents.ucla.edu/individual-student-code

If you engage in these types of unacceptable behaviors in our course, then you will receive a zero as your score for that assignment. If you are caught cheating on an exam, then you will receive a score of zero for the entire exam. These allegations will be referred to the Office of the Dean of Students and can lead to formal disciplinary proceedings. Being found responsible for violations of academic integrity can result in disciplinary actions such as the loss of course credit for an entire term, suspension for several terms, or dismissal from the University. Such negative marks on your academic record may become a major obstacle to admission to graduate, medical, or professional school.

We cannot make exceptions to our campus' policy on academic integrity, and as we hopefully have communicated effectively here, penalties for violations of this policy are harsh. Please do not believe it if you hear that "everyone does it". The truth is, you usually don't hear about imposed disciplinary actions because they are kept confidential. So our advice, just don't do it! Let's embrace what it means to be a true Bruin and together be committed to the values of integrity.

By submitting my assignments and exams for grading in this course, I acknowledge the above-mentioned terms of the UCLA Student Code of Conduct, declare that my work will be solely my own, and that I will not communicate with anyone other than the instructor and proctors in any way during the exams.

Sanjit Sarda
Signature

05/02/2023
Date

Sanjit Sarda
Print Name

805964031
UID

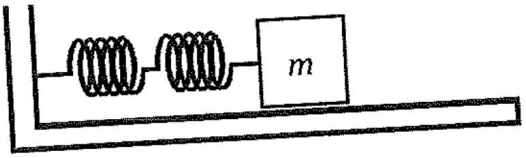
I) Multiple Choice - circle the *one* most correct answer to each question.

1. Two pulses traveling on an infinitely long string are described by $y_1 = \frac{10}{(2x-5t)^2+1}\ mm$ and $y_2 = \frac{-10}{(2x+5t+10)^2+1}\ mm$, with x in meters and t in seconds. Which of the following best describes the behavior of these pulses: C

   a. The pulses travel in the same direction at the same speed.
   b. The pulses meet, cancel, and thus absorb each other, leaving nothing behind afterwards.
   c. The pulses travel in opposite directions, canceling at one instant, then passing through each other.
   d. The pulses reflect off each other after they meet, each one travels in the direction opposite to its original direction of motion.
   e. The pulses meet and then form a standing wave with oscillation but no movement to left or right.

2. A spring having force constant k is connected between a wall and a mass m that sits on a frictionless plane. The mass then oscillates with frequency f. If a second, identical spring is then added between the wall and the first spring, so that the two springs are connected in series, the frequency of oscillation will be: A

   a. $f/2$
   b. $f/\sqrt{2}$
   c. f (unchanged)
   d. $\sqrt{2}f$
   e. $2f$



3. For a trumpet, the note "concert C4b" (233 Hz) is the lowest note played with no keys pressed down, and "concert F4" (349 Hz) is the next. Assuming we can treat the tubing of a trumpet as a straight pipe with both ends open, which normal mode of vibration of the air within the trumpet does the lowest note "concert C4b" correspond to? a

   a. $n = 1$
   b. $n = 2$
   c. $n = 3$
   d. $n = 4$
   e. Another value _____

$v_L < 0$, when apr
$v_s > 0$ when
$v_s > 0$ when apr

4. A simple pendulum is mounted in an elevator. What happens to the period of the pendulum if the elevator accelerates upward? A

   a. It increases.
   b. It decreases.
   c. It stays the same.
   d. We cannot determine the answer without more information.

$\omega = \sqrt{\frac{g}{l}}$ $2\pi f = \sqrt{\frac{g}{l}}$ $\frac{2\pi}{T} = \sqrt{\frac{g}{l}}$ N

5. Doppler shift: choose the best answer. The frequency of a sound wave heard by a listener, compared to that produced at the source, A

   a. Is lower when source moves towards listener, and lower when listener moves towards source.
   b. Is higher when source moves towards listener, and lower when listener moves towards source.
   c. Is lower when source moves towards listener, and higher when listener moves towards source.
   d. Is higher when source moves towards listener, and higher when listener moves towards source.
   e. Does not change, they are the same frequency in all cases.

$f_N = \left(\frac{v + v_L}{v + v_S}\right) f_0$

II) Work-out problems

II.1 (10 points) A nearly massless spring having force constant $k = 100\ N/m$ is connected between a wall and a mass $m = 0.250\ kg$ that sits on a frictionless plane. When the mass is 0.100 m to the right of its equilibrium position, it is observed to have a speed of 1.50 m/s.

a. (4 pts) What is the total energy E of the mass-spring system?
b. (3 pts) What is the amplitude A of the motion?
c. (3 pts) What is the maximum speed of the mass?

(a) Total Energy $= K_e + P_e = \frac{1}{2}kx^2 + \frac{1}{2}mv^2 = \frac{1}{2}\cdot 100\cdot .1^2 + \frac{1}{2}\cdot 25\cdot 1.5^2$

$= .78125\ J$

(b) $\frac{1}{2}kA^2 = \text{Total } E = E = .78125$

$\therefore \frac{1}{2}\cdot 100\cdot A^2 = .78125$

$\therefore A = \sqrt{\frac{.78125}{50}} = .125m$

(c) $\frac{1}{2}mv_{max}^2 = \text{Total } E = E = .78125$

$\therefore \frac{1}{2}\cdot .25\, v_{max}^2 = .78125$

$\therefore v_{max} = \sqrt{\frac{.78125}{.125}} = 2.5\ ms^{-1}$

II.2 (10 points) The sound from a trumpet radiates uniformly in all directions in room temperature air without absorption or reflection. At a distance of 4.0 m from the trumpet the level of sound is 90 dB (measured using Android app "Sound Meter"). The frequency is 349 Hz.

a) (3 pts) What is the intensity of sound in W/m^2 at this distance?
b) (4 pts) What is the pressure amplitude of the sound at this distance?
c) (3 pts) At what distance from the trumpet is the sound intensity 60 dB?

(a) $\beta = 90\,dB = 10\log_{10}\left(\frac{I}{I_0}\right)$ $I_0 = 1E{-}12$ ∴ Solving for I, $\boxed{I = 0.001\ \frac{W}{m^2}}$

(b) $I = \frac{P_m^2}{2\rho v}$ $\rho = 1.3$, $v = 340$ → $0.001 = \frac{P_m^2}{2 \cdot 1.3 \cdot 340}$ ∴ $\boxed{P_m = 0.94\ \frac{N}{m^2}}$

(c) $I = \frac{P}{A}$ ∴ $0.001 = \frac{P}{\pi \cdot 4^2}$ ∴ $P = 0.001 \cdot \pi \cdot 16$

∴ $\beta = 60\,dB = 10\log_{10}\frac{I}{I_0}$

∴ $I = 0.000001\ \frac{W}{m}$

∴ $0.000001 = \frac{P}{A} = \frac{0.001\,\pi \cdot 16}{\pi \cdot d^2}$

∴ Solving for d,

$\boxed{d = 126\ m.}$

$f\frac{2\pi}{k}v \quad (kx-\omega t)$

II.3 (10 points) One common interval training fitness exercise is to energetically wiggle a heavy rope. The rope is tied at the far end to a post, and the rope and the post are made of material that absorbs the energy as the wave goes from the athlete to the post.

Let's suppose such a rope has mass $m = 5.0\ kg$ and length $l = 4.0\ m$. The athlete then stretches the rope with a tension force $F = 200\ N$, and produces transverse waves on the string having maximum displacement of $\pm 0.50\ m$, and a frequency of $1.5\ Hz$.

a. (2 pts) What is the speed of waves on this string?
b. (2 pts) What is the frequency of the waves?
c. (2 pts) What is the wave number of the waves?
d. (4 pts) What is the average power exerted by the athlete to produce these waves?

$y = A\cos(kx-\omega t)$ $A = 0.5$

(a) $v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{F}{m/l}} = \sqrt{\frac{200}{5/4}} = 4\sqrt{10} = 12.65\ ms^{-2}$

(b) $f = 1.5\ Hz$

(c) $f\frac{2\pi}{k} = v \therefore k = \frac{f(2\pi)}{v} = \frac{1.5(2\pi)}{12.65} = 0.75$

(d) $P_{av} = \frac{1}{2}\sqrt{\frac{m}{l}F}\cdot\omega^2\cdot A^2 = \frac{1}{2}\sqrt{\frac{m}{l}F}\cdot(kv)^2\cdot A^2$

$= \frac{1}{2}\sqrt{\frac{5}{4}\cdot 200}\cdot(.75\cdot 12.65)^2\cdot .5^2$

$= 177.9\ W.$

with rounding $\uparrow$

$=$

Straight from calc $\rightarrow$ $175.6\ W$