Instructor(s): *C. Parks*

PHYSICS DEPARTMENT
PHY2053, Summer 2015   EXAM 3   July 31, 2015

Name (print, last first): _____   Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.
(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number)**.
Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or <u>blue</u> or <u>black</u> ink.** Do not make any stray marks or some answers may be counted as incorrect.
(5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.
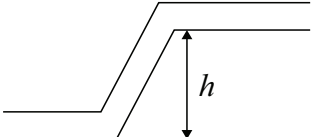

Given Information:

$g = 9.80$ m/s^2 1 atmosphere $= 1.01 \times 10^5$ Pa   Density of water $= 1000$ kg/m^3
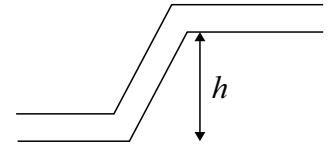1 m $= 100$ cm   1 minute $= 60$ seconds $A = \pi r^2$

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1. A 1000-kg automobile is raised by a hydraulic lift. A 196-N force applied to the input piston is needed to lift the car. Now a 1500-kg truck is being worked on. What input force is needed to lift the heavier truck?

   (1) 294 N   (2) 98 N   (3) 30 N   (4) 348 N   (5) None of these.

2. A 1000-kg automobile is raised by a hydraulic lift. A 245-N force applied to the input piston is needed to lift the car. Now a 1600-kg truck is being worked on. What input force is needed to lift the heavier truck?

   (1) 392 N   (2) 147 N   (3) 40 N   (4) 482 N   (5) None of these.

3. A block of wood is tied to the bottom of a large container of water so that the block is completely submerged. The density of the block is 800 kg/m^3 and its volume is 0.030 m^3. What is the tension in the rope holding the block down in the water?

   (1) 59 N   (2) 6.0 N   (3) 290 N   (4) 235 N   (5) None of these.

4. A block of wood is tied to the bottom of a large container of water so that the block is completely submerged. The density of the block is 700 kg/m^3 and its volume is 0.030 m^3. What is the tension in the rope holding the block down in the water?

   (1) 88 N   (2) 9.0 N   (3) 290 N   (4) 206 N   (5) None of these.

5. A 12-m long pipe has a constant cross section and is part of a closed plumbing system so that neither end is at atmospheric pressure. The pipe is straight and arranged so that one end is $h = 8.16$ m higher than the other end. What is the difference in the pressure of the ends of the pipe? Assume that water is being used in the pipe and that viscous effects can be neglected.

   (1) 80,000 Pa, the lower end at higher pressure
   (2) 80,000 Pa, the higher end at higher pressure
   (3) 8200 Pa, the lower end at higher pressure
   (4) 8200 Pa, the higher end at higher pressure
   (5) None of these.

6. A 12-m long pipe has a constant cross section and is part of a closed plumbing system so that neither end is at atmospheric pressure. The pipe is straight and arranged so that one end is $h = 9.19$ m higher than the other end. What is the difference in the pressure of the ends of the pipe? Assume that water is being used in the pipe and that viscous effects can be neglected.

(1) 90,000 Pa, the lower end at higher pressure
(2) 90,000 Pa, the higher end at higher pressure
(3) 9200 Pa, the lower end at higher pressure
(4) 9200 Pa, the higher end at higher pressure
(5) None of these.

7. A container of ethanol $\eta = 1.0 \times 10^{-3}$ Pa·s is being syphoned. The tube is 2.54 cm in radius and 2.0 m long. The pressure difference across the pipe is 1000 Pa. How long will it take to fill a 1.0 m^3 container?

(1) 12 s   (2) 18 s   (3) 24 s   (4) 30 s   (5) None of these.

8. A container of ethanol $\eta = 1.0 \times 10^{-3}$ Pa·s is being syphoned. The tube is 2.54 cm in radius and 2.0 m long. The pressure difference across the pipe is 1000 Pa. How long will it take to fill a 1.5 m^3 container?

(1) 18 s   (2) 24 s   (3) 30 s   (4) 36 s   (5) None of these.

9. A 2.4-cm diameter steel cable supports a 250 kg mass. What is the fractional increase of the length of the cable if $Y = 2.0 \times 10^{11}$ Pa for steel? The cable is originally 11 m long.

(1) 2.7×10^{-5} (2) 6.8×10^{-5} (3) 2.8×10^{-6} (4) 6.9×10^{-7} (5) None of these.

10. A 2.4-cm diameter steel cable supports a 250 kg mass. What is the fractional increase of the length of the cable if $Y = 2.0 \times 10^{11}$ Pa for steel? The cable is originally 15 m long.

(1) 2.7×10^{-5} (2) 6.8×10^{-5} (3) 2.8×10^{-6} (4) 6.9×10^{-7} (5) None of these.

11. A mass m is attached to a spring with spring constant k and the mass executes simple harmonic motion. What must happen to double the period of the simple harmonic oscillator?

(1) double m, halve k (2) double m, halve k (3) halve m, double k (4) halve m, halve k (5) None of these.

12. A mass m is attached to a spring with spring constant k and the mass executes simple harmonic motion. What must happen to halve the period of the simple harmonic oscillator?

(1) halve m, double k (2) double m, halve k (3) double m, halve k (4) halve m, halve k (5) None of these.

13. A simple pendulum completes 41 oscillations in one minute. What is the length of the pendulum?

(1) 0.53 m   (2) 0.74 m   (3) 0.38 m   (4) 0.27 m   (5) None of these.

14. A simple pendulum completes 26 oscillations in one minute. What is the length of the pendulum?

(1) 1.3 m   (2) 1.8 m   (3) 0.92 m   (4) 0.66 m   (5) None of these.

15. A 2.0-kg mass is oscillating about the origin at 24 rad/s. The amplitude of the oscillations is 0.040 m. At what position is the kinetic energy equal to twice the potential energy?

    (1) 0.023 m   (2) 0.020 m   (3) 0.033 m   (4) 0.013 m   (5) None of these.

16. A 2.0-kg mass is oscillating about the origin at 24 rad/s. The amplitude of the oscillations is 0.040 m. At what position is the potential energy equal to twice the kinetic energy?

    (1) 0.033 m   (2) 0.020 m   (3) 0.023 m   (4) 0.027 m   (5) None of these.

17. An alarm emits sound of power 0.51 W uniformly in all directions. How much energy passes through a rectangle 20 m from the alarm in one minute? The dimensions of the rectangle are 3.0 m by 4.0 m.

    (1) 0.073 J   (2) 6.1 J   (3) 0.0012 J   (4) 0.92 J   (5) None of these.

18. An alarm emits sound of power 0.60 W uniformly in all directions. How much energy passes through a rectangle 20 m from the alarm in one minute? The dimensions of the rectangle are 3.0 m by 4.0 m.

    (1) 0.086 J   (2) 7.2 J   (3) 0.0014 J   (4) 1.1 J   (5) None of these.

19. Two coherent waves interfere. When the interference is constructive, the amplitude is 0.030 m and when the interference is destructive, the amplitude is 0.020 m. What is the amplitude of the more intense wave?

    (1) 0.025 m   (2) 0.020 m   (3) 0.015 m   (4) 0.005 m   (5) None of these.

20. Two coherent waves interfere. When the interference is constructive, the amplitude is 0.030 m and when the interference is destructive, the amplitude is 0.020 m. What is the amplitude of the less intense wave?

    (1) 0.005 m   (2) 0.020 m   (3) 0.015 m   (4) 0.025 m   (5) None of these.

21. A 15-kg mass is hanging from a 1.9 m long string. The linear density of the string is 0.0050 kg/m. What is the lowest frequency possible for a standing wave in the string?

    (1) 45 Hz   (2) 90 Hz   (3) 14 HZ   (4) 29 Hz   (5) None of these.

22. A 15-kg mass is hanging from a 2.1 m long string. The linear density of the string is 0.0050 kg/m. What is the lowest frequency possible for a standing wave in the string?

    (1) 41 Hz   (2) 82 Hz   (3) 13 Hz   (4) 26 Hz   (5) None of these.

23. How much louder is a 71 dB sound than a 65 dB sound?

    (1) 4.0 times   (2) 6.0 times   (3) 2.0 times   (4) 8.0 times   (5) None of these.

24. How much louder is a 71 dB sound than a 55 dB sound?

    (1) 40 times   (2) 60 times   (3) 20 times   (4) 80 times   (5) None of these.

25. Two tuning forks A and B, excite the lowest resonant frequencies in two air columns of the same length, but A's column is closed at one end and B's column is open at both ends. What is the ratio of B's frequency to A's frequency

(1) 2/1   (2) 1/2   (3) 3/4   (4) 4/3   (5) None of these.

26. Two tuning forks A and B, excite the lowest resonant frequencies in two air columns of the same length, but A's column is closed at one end and B's column is open at both ends. What is the ratio of A's frequency to B's frequency

(1) 1/2   (2) 2/1   (3) 3/4   (4) 4/3   (5) None of these.

27. Today is your first day working at the tuning fork factory. You work on the assembly line manufacturing tuning forks that resonate at 440 Hz. When one of your tuning forks is tested against the standard, a beat frequency of 15 Hz is heard. What do you know for sure?

(1) Your tuning fork resonates at either 425 Hz or 455 Hz.
(2) Your tuning fork resonates at 425 Hz.
(3) Your tuning fork resonates at 455 Hz.
(4) You should look for another job.
(5) You can tune a piano but you cannot tuna fish.

28. Today is your first day working at the tuning fork factory. You work on the assembly line manufacturing tuning forks that resonate at 440 Hz. When one of your tuning forks is tested against the standard, a beat frequency of 12 Hz is heard. What do you know for sure?

(1) Your tuning fork resonates at either 428 Hz or 452 Hz.
(2) Your tuning fork resonates at 428 Hz.
(3) Your tuning fork resonates at 452 Hz.
(4) You should look for another job.
(5) You can tune a piano but you cannot tuna fish.

29. Standing on the side of the road you see an ambulance speed by. As it heads directly towards you, you hear the siren emit frequency f_1. As it heads directly away from you, you hear frequency f_2. If the siren's rest frequency is 570 Hz, what are f_1 and f_2? The speed of sound is 340 m/s and the speed of the ambulance is 40 m/s.

(1) $f_1 = 646$ Hz, $f_2 = 510$ Hz
(2) $f_1 = 510$ Hz, $f_2 = 646$ Hz
(3) $f_1 = 503$ Hz, $f_2 = 637$ Hz
(4) $f_1 = 637$ Hz, $f_2 = 503$ Hz
(5) None of these.

30. Standing on the side of the road you see an ambulance speed by. As it heads directly towards you, you hear the siren emit frequency f_1. As it heads directly away from you, you hear frequency f_2. If the siren's rest frequency is 635 Hz, what are f_1 and f_2? The speed of sound is 340 m/s and the speed of the ambulance is 40 m/s.

(1) $f_1 = 720$ Hz, $f_2 = 568$ Hz
(2) $f_1 = 568$ Hz, $f_2 = 720$ Hz
(3) $f_1 = 560$ Hz, $f_2 = 710$ Hz
(4) $f_1 = 710$ Hz, $f_2 = 560$ Hz
(5) None of these.

FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE
TYPE 1
Q# S 1
Q# S 2
TYPE 2

Q# S 3
Q# S 4
TYPE 3
Q# S 5
Q# S 6
TYPE 4
Q# S 7
Q# S 8
TYPE 5
Q# S 9
Q# S 10
TYPE 6
Q# S 11
Q# S 12
TYPE 7
Q# S 13
Q# S 14
TYPE 8
Q# S 15
Q# S 16
TYPE 9
Q# S 17
Q# S 18
TYPE 10
Q# S 19
Q# S 20
TYPE 11
Q# S 21
Q# S 22
TYPE 12
Q# S 23
Q# S 24
TYPE 13
Q# S 25
Q# S 26
TYPE 14
Q# S 27
Q# S 28
TYPE 15
Q# S 29
Q# S 30