

DIAGNOSTIC TEST IN GENERAL PHYSICS 1 – ANSWERS KEY
SY 2022-2023

Instructions: Read each question carefully and shade the correct answer in the answer sheet provided to you. Do not write anything on this test questionnaire.

1. What do you call this statistical measurement of physical quantities which measures how far each value in the data set is from the mean?
A. mean
B. median
C. mode
D. variance
2. Joseph measures his bathroom tiles to be 10 in by 8 in. Given the conversion factor, 1 in = 2.54 cm, what are the length and width in cm?
A. 20.32 cm by 19.9 cm
B. 25.5 cm by 20.32 cm
C. 25.4 cm by 24.5 cm
D. 35.4 cm by 12.32 cm
3. The following steps of converting units below are correct EXCEPT
A. km → cm → m
B. hr → min → s
C. kL → L → mL
D. kg → mg → g
4. Accuracy tells us how close the measurement is to the true value of the quantity that was measured. Consider 3.7 mL to be the true value, which set of measurements below is accurate?
A. 3.85 mL, 3.86 mL, 3.83 mL, 3.88 mL
B. 3.25 mL, 3.42 mL, 3.35 mL, 3.20 mL
C. 3.70 mL, 3.72 mL, 3.71 mL, 3.73 mL
D. 3.10 mL, 3.24 mL, 3.34 mL, 3.12 mL
5. Which of the following instances below demonstrates a random error?
A. calibrating instrument improperly
B. not setting an instrument to zero prior to its use
C. not reading the meniscus at eye level for a volume measurement
D. positioning slightly different each time weighing on a bathroom scale
6. If given a chance to design a vehicle, what things would you consider to have the best acceleration?
A. It should exert lesser force, and its mass must be lighter.
B. It should exert lesser force, but its mass must be greater.
C. It should exert greater force, and its mass must be lighter.
D. It should exert greater force, and its mass must be greater also.

7. It is defined as the velocity of an object in the rest frame of another object.
- A. relative motion
 - B. relative velocity**
 - C. instantaneous velocity
 - D. instantaneous acceleration
8. Two trains, A and B are travelling towards east with velocities $V_b = 1.5 \text{ m/s}$ and $V_b = 2.5 \text{ m/s}$. What is the velocity of train B with respect to train A?
- A. $+1.0 \text{ m/s}$**
 - B. -1.0 m/s
 - C. $+3.5 \text{ m/s}$
 - D. -3.5 m/s
9. Considering that two cars are travelling on the same direction with $V_B = 4.5 \text{ m/s}$. In this instance, the velocity of A with respect to B is $V_{AB} = +2.0 \text{ m/s}$. Which car has greater velocity?
- A. car A**
 - B. car B
 - C. both have the same velocity
 - D. relative velocities cannot be solved
10. Do you agree that gravity has a great role in projectile motion?
- A. Yes, because it speeds up the motion of the object.
 - B. No, because the object's horizontal acceleration is always zero anyway.
 - C. Yes, because it is the one that influences the object's parabolic trajectory.**
 - D. No, because whether the gravity is present or not, the object would still have a downward acceleration anyway.
11. A soccer player hits the soccer ball so that it leaves at speed $v_0 = 26.0 \text{ m/s}$ at an angle $\theta_0 = 39.0^\circ$. Solve for the maximum height, h reached by the ball.
- A. 0.53 m
 - B. 2.79 m
 - C. 13.7 m**
 - D. 27.3 m
12. What would you infer from a free-body diagram (FBD) that shows only normal force directed upward and a weight directed downward?
- A. Something with mass is at rest on top of a surface.**
 - B. Something with mass is accelerating to the right direction.
 - C. Something with mass is connected to a thread and is hanged from the ceiling.
 - D. Something with mass is connected to a thread and is accelerating to the left direction.

13. What do you call to the force that is acted on an object due to gravity?
- Inertia
 - Mass
 - Tension
 - Weight**
14. How do you describe the direction of the weight and normal force?
- The two have the same direction.
 - The magnitude of these two forces is always equal.
 - The two are always in the completely opposite direction.
 - The two have different directions regardless of the surface.**
15. Melay is dragging a box of about 115 N within 1.5 m. If the angle between the force and displacement is 25° , what is the work dissipated?
- 152.3 J
 - 153.2 J
 - 153.6 J
 - 156.3 J**
16. Given the work done, distance traveled, and angle between forces. What possible formula could be derived to find the exerted force?
- $F = \frac{W}{d \sin \theta}$
 - $F = \frac{W}{d \cos \theta}$**
 - $F = \frac{W}{d \tan \theta}$
 - $F = \frac{W}{d \csc \theta}$
17. Consider the situation of a block being pulled across a table with a constant force of 5 N over a displacement of 5 m, then the force gradually tapers off over the next 5 m. Based on Figure 1, in which color will work be higher?



Figure 1. Force vs. Displacement Graph

(Source: <https://www.aplusphysics.com/courses/honors/wep/work.html>)

- Red**
- Green
- Both enjoy equal work
- The information is insufficient.

18. What do you call that graph of a mechanical system's potential energy which is easily accomplished in a one-dimensional system?
- A. Energy diagram
 - B. Potential energy diagram**
 - C. Gravitational energy diagram
 - D. Potential gravitational energy diagram
19. Which of the following best describes a neutral equilibrium?
- A. It is any maximum point in a potential energy curve.
 - B. It is when the gravitational potential energy of a certain object remains constant regardless of its position.**
 - C. It is the net assumed conservative force, the net force on a particle, given that the slope of its potential energy curve is zero.
 - D. It is when the position is at the minimum potential energy, and therefore a particle will feel a force restoring it to this position as it moves away.

For items 20-21, refer to Figure 2.

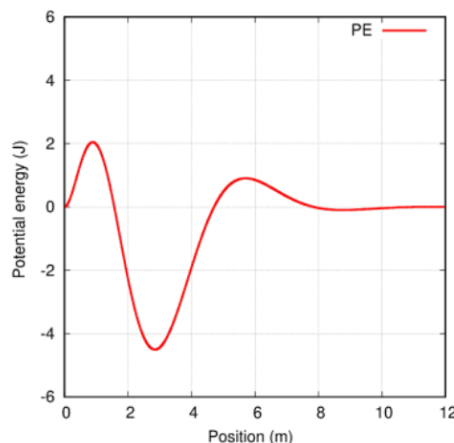


Figure 1. Potential Energy Diagram (Source: spiff.rit.edu/classes/phys211/workshops/w_force_pote/pote_graph.html)

20. Which position is the equilibrium stable?
- A. 1
 - B. 2
 - C. 3**
 - D. 4
21. How many points are considered unstable?
- A. 1
 - B. 2**
 - C. 3
 - D. 4

22. What is the gravitational potential energy of a 0.15-kg ball elevated for about 8 m?
- A. 0.114 J
 - B. 1.14 J
 - C. 11.4 J
 - D. 114 J
23. You want to design a racing car to get through road curves smoothly. Which should be considered?
- A. Low ground clearance, light chassis, and light roof
 - B. Light roof, heavy chassis, and low ground clearance
 - C. Heavy roof, high ground clearance, and light chassis
 - D. Heavy roof, high ground clearance, and heavy chassis
24. Which of the following is NOT a condition for an object to be in static equilibrium?
- A. The object is not moving.
 - B. It is in rotational equilibrium.
 - C. It is in translational equilibrium.
 - D. The object is at constant velocity
25. A uniform rod with a mass of 2 kg and a length of 2.0 m is pivoted about an axis perpendicular to the rod and 50 cm from its left end. What is its rotational inertia about this axis?
- A. 2.57 kg·m²
 - B. 2.17 kg·m²
 - C. 1.17 kg·m²
 - D. 0.67 kg·m²
26. A seesaw with mass x is perfectly balanced with a fulcrum in the center. If mass x changes uniformly, do the net torque change?
- A. Yes, any increase in weight will increase torque.
 - B. Yes, because the gravitational force increases with more mass, and torque is related to force.
 - C. No, because the net torque is still zero despite increase in one of the individual components.
 - D. No, because it is balanced, which means that the net torque is zero; a uniform increase in weight keeps it balanced, allowing the net torque to remain zero.

27. A fan spins with a constant angular speed of 500 rad/s. How long will it take to cover an angle of 2π rad (one revolution)?
- A. 76.9 s
 - B. 6.28 s
 - C. 0.013 s
 - D. 0.002 s
28. In different cases, angular momentum is a product of _____.
- A. linear inertia and angular velocity
 - B. rotational inertia and linear velocity
 - C. rotational inertia and angular velocity
 - D. linear momentum and angular velocity
29. A resultant force of 4.5 N, directed 30° north of east, is acting on a particle. What force is needed to bring the particle into a state of equilibrium?
- A. 4.5 N, 30° north of east
 - B. 4.5 N, 30° north of west
 - C. 4.5 N, 30° south of east
 - D. 4.5 N, 30° south of west
30. Which one of the following definitions describes the term “interference”?
- A. It happens when one wave travels alone.
 - B. It occurs only when two or more waves overlap and combine.
 - C. It occurs when two or more waves combine and neutralize each other.
 - D. It is observed only when the phase difference between the two waves is zero.
31. What will happen when a compression interferes with another compression?
- A. They counteract and diminish.
 - B. They combine to create a rarefaction.
 - C. They combine to create a larger compression.
 - D. They combine but the wave effects remain the same.
32. Which of the following best describes the principle of superposition?
- A. Two stationary waves superimpose to give two progressive waves.
 - B. Two progressive waves are superimposed to give stationary waves.
 - C. A diffraction pattern consists of many interference patterns superimposed on one another.
 - D. The total displacement due to several waves is the sum of the displacements due to those waves acting individually.

33. What causes sound when you pluck the string of a guitar?
- A. Tuning machines
 - B. Vibrations of the string**
 - C. Sound hole in the middle of the guitar
 - D. Frets or metal strips along the length of the neck
34. A guitar string has a length of 0.50 m and produces a wave speed of 565 m/s along it. What is the frequency of the 3rd harmonic?
- A. 93.2 Hz
 - B. 282.5 Hz
 - C. 1130 Hz
 - D. 1712 Hz**

35. A wave generated at the left end of the medium undergoes reflection at the fixed end on the right side of the medium, as shown in Figure 3.

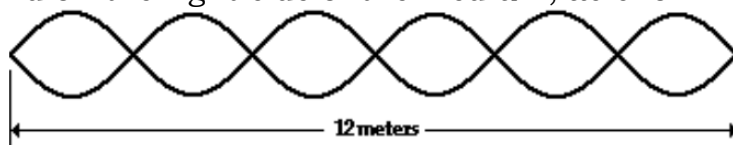


Figure 3. Standing Wave Pattern (Source: <https://www.physicsclassroom.com/reviews/sound/Sound-Waves-and-Music-Review-Answers-2>)

How many antinodes are shown in this standing wave pattern?

- A. 3.0
 - B. 5.0
 - C. 6.0**
 - D. 7.0
36. What is the formula for density?
- A. density = mass x volume
 - B. density = mass / volume**
 - C. density = mass + volume
 - D. density = mass – volume
37. What is the volume of 150 g of lead if it has a density of 11.3 g/cm³?
- A. 0.075 g
 - B. 13.3 g
 - C. 13.3 cm³**
 - D. 1695 cm³

38. How does a plane fly, theoretically?
- A. Airplanes have jet blasters beneath the wing.
 - B. Gravity creates an equal and opposite reaction because it isn't that strong.
 - C. High pressure presses up against the low pressure on the bottom of the wing.
 - D. High pressure presses down against the high pressure on the bottom of the wing.
39. Considering Bernoulli's Principle, what do you think will happen if you set a shower curtain next to running water?
- A. Curtains stays the same
 - B. Water gets the curtain wet
 - C. Curtain goes in toward the shower
 - D. Curtain goes outward from the shower
40. Why is the top of an airplane wing curved?
- A. To make the wing look cool
 - B. To create an area of low pressure above the wing
 - C. To create an area of high pressure above the wing
 - D. To create equal pressure above and below the wing
41. Which of the following statements is NOT true about the laws of thermodynamics?
- A. Heat flows from an object with low temperature to an object with higher temperature.
 - B. Thermal equilibrium of two objects with different temperatures will attain at some point.
 - C. An object with a lower temperature will lose its energies when in direct contact with an object with a higher temperature.
 - D. An object with a higher temperature will gain energy from an object with a lower temperature when they are in direct contact.
42. Why is the electric wire that is connected in the post outside a little bit saggy and not tightly tied?
- A. So that it will not be tangled by the other wires
 - B. To make space for other wires to easily connect
 - C. So that it will not break once the wire will expand
 - D. So that it will not hard for the line men to reach it

43. What is thermal expansion?
- A. Is a decrease in the volume of a material when temperature decreases
 - B. Is an increase in the volume of a material when temperature increases**
 - C. The transfer of thermal energy between materials by the collisions of particles
 - D. The transfer of electric potential energy between materials by the collisions of particles
44. A material of length L_1 at temperature θ_1 K is subjected to a temperature rise of θ K. The coefficient of linear expansion of the material α K⁻¹. What is the expansion of the material?
- A. $L_1\alpha$
 - B. $L_1\alpha(\theta - \theta_1)$
 - C. $L_2[1 + \alpha\theta]$
 - D. $L_1[1 + \alpha(\theta - \theta_1)]$**
45. Calculate the change in length of a 100-mm aluminum bar that has increased in temperature by 55 °C. (Take the coefficient of expansion to be 25×10^{-6})
- A. 0.1375mm**
 - B. 0.258mm
 - C. 1.23mm
 - D. 1.37mm
46. Which of the following laws accounts for temperature, volume, pressure, and moles of gas within an individual system?
- A. Boyle's Law
 - B. Charles' Law
 - C. Ideal Gas Law**
 - D. Gay-Lussac's Law
47. What is the density of carbon dioxide in kg/m³ at 27 °C at 100 kPa?
- A. 1.76**
 - B. 2.76
 - C. 3.76
 - D. 4.76
48. What is the area enclosed by the PV graph of a complete heat engine cycle?
- A. the heat intake per cycle
 - B. Equals the heat output per cycle
 - C. Equals the work done on the engine per cycle
 - D. Equals the work done by the engine per cycle**

49. A gas expands and does 215 J of work on a piston. The gas exerts a pressure of 1230 Pa on the piston. What is the change in volume of the gas?

- A. 0.175 m³
- B. 5.72 m³
- C. 12.1 m³
- D. 264000 m³

50. The temperature of an ideal gas increases from 20 °C to 40 °C while the pressure stays the same. What happens to the volume of the gas?

- A. It doubles
- B. It quadruples
- C. It slightly increases
- D. It slightly decreases