Jamb Physics Mock

Name:---------- Duration: 50 Minutes

Item number	1	2	3	4	5	6	7	8	9	10
Your response										
Item number	11	12	13	14	15	16	17	18	19	20
Your response										
Item number	21	22	23	24	25	26	27	28	29	30
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Your response										

Instruction: Please, answer **ALL** questions. Write your response for each item in the top box (e.g A)

1. Consider the following physical quantities:

I. Mass II. Time III. Temperature IV. Displacement

Which of the above is a vector quantity?

A. I only B. II only C. III only D. IV only

2. A rocket is launched from the Earth's surface. What is the minimum velocity it must attain to escape the Earth's gravitational pull completely? (Take the radius of the Earth as R and the acceleration due to gravity at the surface as g)

A. $\sqrt{(gR)}$ B. $\sqrt{(2gR)}$ C. gR D. 2gR

3. A hydraulic lift has a small piston with an area of 0.01 m^2 and a large piston with an area of 0.1 m^2. If a force of 100 N is applied to the small piston, what is the maximum load that can be lifted by the large piston?

A. 10 N B. 100 N C. 1000 N D. 10000 N

4. A submarine is submerged at a depth of 100 m in seawater. If the density of seawater is 1030 kg/m^3 and the atmospheric pressure is 101,325 Pa, what is the total pressure on the submarine's hull? (Take g = 10 m/s^2)

A. 101,325 Pa B. 1,030,000 Pa C. 1,131,325 Pa D. 10,300 Pa

5. A steel bridge is 1000 m long at a temperature of 20 °C. If the coefficient of linear expansion for steel is 12 x 10^{-6} /°C, what will be the increase in length of the bridge when the temperature rises to 40 °C on a hot summer day? The bridge is painted white to reflect sunlight, and its mass is 10,000 kg.

A. 0.12 m B. 0.24 m C. 1.2 m D. 2.4 m

6. A river flows with a velocity of 3 m/s due east. A boat starts from the south bank and wants to reach a point directly opposite on the north bank. If the boat's speed in still water is 5 m/s, at what angle to the north must the boat be steered?

A. 30° B. 36.9° C. 45° D. 53.1°

7. A uniform ladder of length 5 m and weight 200 N leans against a smooth vertical wall. The coefficient of static friction between the ladder and the rough horizontal ground is 0.4. If the ladder makes an angle of 53° with the ground, what is the maximum distance a person of weight 600 N can climb up the ladder before it starts to slip?

A. 1.5 m B. 2.5 m C. 3.5 m D. 4.5 m

8. A block of mass 2 kg is released from rest at the top of a frictionless inclined plane of height 1 m. At the bottom of the incline, it collides elastically with another block of mass 4 kg, initially at rest. What is the velocity of the 4 kg block after the collision?

A. 1 m/s B. 2 m/s C. 2.67 m/s D. 4 m/s

9. A hydraulic press has a small piston of radius 2 cm and a large piston of radius 20 cm. If a force of 50 N is applied to the small piston, what is the maximum weight that can be lifted by the large piston? The hydraulic fluid has a density of 800 kg/m^3.

A. 500 N B. 1000 N C. 2500 N D. 5000 N

10. A spring is stretched by 10 cm when a mass of 2 kg is hung from it. If the mass is then pulled down further by 5 cm and released, what is the period of oscillations? (Take g = 10 m/s²)

    A. 0.2 s B. 0.45 s C. 0.63 s D. 0.9 s

11. A screw jack has a pitch of 2 mm and an efficiency of 40%. If an effort of 50 N is applied to the handle of length 0.5 m, what is the maximum load that can be lifted?

    A. 200 N B. 400 N C. 600 N D. 1000 N

12. A thermos flask is designed to minimize heat transfer. Which of the following statements about a thermos flask is **FALSE**?

    A. The vacuum between the walls prevents heat transfer by conduction and convection

    B. The silvered inner walls minimize heat transfer by radiation

    C. The insulated stopper reduces heat transfer by conduction

    D. The vacuum between the walls allows for efficient heat transfer by radiation

13. A body of mass 36kg falls through a viscous liquid which offers a drag force of 260N on the body. The upthrust on the body at terminal velocity is [g = 10 ms-2]

    A. 50N B. 100N C. 310N D. 620N

14. A projectile is launched at a 30° angle with an initial velocity of 20 m/s, what is its initial vertical velocity component?

    A. 10 m/s B. 10√3 m/s C. 20√2 m/s D. 20√3/2 m/s

15. A pressure cooker is used to cook food faster than a regular pot. Which of the following statements BEST explains why a pressure cooker cooks food faster?

    A. The increased pressure inside the pressure cooker increases the boiling point of water, allowing the food to cook at a higher temperature.
    B. The increased pressure inside the pressure cooker decreases the boiling point of water, allowing the food to cook at a lower temperature.
    C. The increased pressure inside the pressure cooker increases the specific latent heat of vaporization of water, requiring more energy to cook the food.
    D. The increased pressure inside the pressure cooker decreases the specific latent heat of vaporization of water, requiring less energy to cook the food.

16. A train is approaching a stationary observer at a speed of 30 m/s. The train's whistle emits a sound with a frequency of 500 Hz. If the speed of sound in air is 340 m/s, what frequency will the observer hear? The air temperature is 25 °C, and the relative humidity is 50%.

    A. 455.9 Hz B. 500 Hz C. 548.8 Hz D. 550 Hz

17. Which of the following statements is **FALSE** regarding the nature of light? The speed of light in a vacuum is approximately 3 x 10^8 m/s.

    A. Light travels in straight lines.
    B. Light can be reflected and refracted.
    C. Light is a form of electromagnetic radiation.
    D. Light always requires a medium to propagate.

18. A metal rod of length 0.5 m and cross-sectional area 0.01 m² has one end maintained at 100 °C and the other end at 0 °C. If the thermal conductivity of the metal is 400 W/mK, what is the rate of heat transfer (heat flux) through the rod? The rod's mass is 2 kg, and its specific heat capacity is 385 J/kg°C.

A. 200 W B. 400 W C. 800 W D. 8000 W

19. A pinhole camera produces an inverted image because:

A. Light travels in straight lines B. Light can be reflected C. Light can be refracted D. Light can be diffracted

20. Two-point charges, +3 µC and -2 µC, are placed 0.15 meters apart in a vacuum. A third charge, +1 µC, is placed at a point on the line joining the first two charges, such that it experiences no net electrostatic force. The dielectric constant of the vacuum is 8.85×10^{-12} F/m. At what distance from the +3 µC charge should the third charge be placed? The mass of the third charge is 0.02 grams.

A. 0.05 m B. 0.09 m C. 0.1 m D. 0.15 m

21. An electroscope is initially uncharged. A positively charged rod is brought near the electroscope, but not touching it. The leaves of the electroscope diverge. Which of the following statements BEST explains this observation? The electroscope is made of copper, and the rod is made of glass.

A. Positive charges from the rod are transferred to the electroscope by conduction.
B. Negative charges from the electroscope are transferred to the rod by conduction.
C. The leaves of the electroscope acquire a net positive charge due to induction.
D. The leaves of the electroscope acquire a net negative charge due to induction.

22. Three capacitors with capacitances of 2 µF, 3 µF, and 6 µF are connected in series. What is the equivalent capacitance of the combination? The capacitors are initially uncharged, and the circuit is connected to a 9 V battery.

A. 1 µF B. 11 µF C. 0.5 µF D. 2 µF

23. Which of the following statements **BEST** describes the concept of electromotive force (emf)?

A. It is the force that drives electrons through a circuit.
B. It is the potential difference across the terminals of a cell when no current is flowing.
C. It is the resistance offered by a cell to the flow of current.
D. It is the rate at which electrical energy is converted into other forms of energy.

24. A wire of length 2 meters and cross-sectional area 0.5 mm² has a resistance of 4 ohms. What is the resistivity of the material of the wire? The wire is made of copper, and its density is 8960 kg/m³.

A. 1×10^{-6} Ωm B. 1×10^{-8} Ωm C. 2×10^{-8} Ωm D. 0.5×10^{-8} Ωm

25. Three resistors with resistances of 3 ohms, 4 ohms, and 6 ohms are connected in parallel. What is the equivalent resistance of the combination? The resistors are made of carbon, and the circuit is powered by a 12 V battery.

A. 13 ohms B. 0.769 ohms C. 1.33 ohms D. 4 ohms

26. A cell has an emf of 1.5 V and an internal resistance of 0.5 ohms. If it is connected to an external resistance of 2 ohms, what will be the reading on a voltmeter connected across the terminals of the cell?

A. 0 V B. 0.5 V C. 1.2 V D. 1.5 V

27. A proton with a charge of 1.6×10^{-19} C moves with a velocity of 5×10^{6} m/s at an angle of 30° to a uniform magnetic field of strength 0.2 T. What is the magnitude of the force experienced by the proton? The mass of the proton is 1.67×10^{-27} kg.

A. 0 N B. 8×10^{-14} N C. 1.6×10^{-13} N D. 4×10^{-14} N

28.

I. Latent heat is the energy required to change the state of a substance without a change in temperature.
II. Specific latent heat is the energy required to change the state of 1 kg of a substance without a change in temperature.
III. Latent heat is the energy required to change the temperature of a substance.
I. Specific latent heat is the energy required to change the temperature of 1 kg of a substance.

Which of the above statements BEST describes the difference between latent heat and specific latent heat?

A. I and II only B. II and III only C. I and IV only D. III and IV only

29. A coil of wire is connected to a sensitive galvanometer. A bar magnet is moved towards the coil, causing the galvanometer needle to deflect. Which of the following actions would NOT increase the magnitude of the deflection?

A. Increasing the speed at which the magnet is moved
B. B. Increasing the strength of the magnet
C. C. Increasing the number of turns in the coil
D. D. Reversing the direction of the magnet's motion

30.

I. Heat transfer from a hot stove burner to a pot.
II. Heat transfer from the Sun to the Earth.
III. Rising of warm air and sinking of cool air.
IV. Heat transfer through a metal rod.

Which of the above scenarios primarily involves heat transfer through convection?

A. I only B. II only C. III only D. I and IV only

31. Which of the following is NOT an application of eddy currents?

A. Induction furnace
B. Magnetic braking in trains
C. Metal detectors
D. Transformers

32. Which of the following statements **BEST** describes the process of electrical discharge through a gas? The gas is contained in a glass tube with a potential difference of 1000 V applied across it.

A. It occurs only when the gas is heated to a very high temperature.
B. It involves the flow of free electrons and ions created by the ionization of gas molecules.
C. It is independent of the potential difference applied across the gas.
D. It results in the emission of only visible light.

33. Which of the following applications does NOT rely on the conduction of electricity through gases?

A. Fluorescent lamps
B. Neon signs
C. Lightning arrestors
D. Electroplating

34. A lightning arrestor is installed on top of a tall building to protect it from lightning strikes. Which of the following statements **BEST** explains the working principle of a lightning arrestor?

A. It attracts lightning strikes and conducts the current safely to the ground, preventing damage to the building
B. It repels lightning strikes, ensuring they do not hit the building
C. It ionizes the air around the building, making it less likely for lightning to strike
D. It absorbs the energy of a lightning strike, dissipating it harmlessly

35. Which of the following statements **BEST** describes the limitation of the Rutherford model of the atom?

A. It could not explain the stability of atoms
B. . B. It did not account for the existence of isotopes.
C. C. It failed to explain the discrete energy levels of electrons.
D. D. It did not predict the existence of the nucleus.

36. In a photoelectric effect experiment, light of frequency 8 x 10^14 Hz is incident on a metal surface. If the work function of the metal is 3 eV, what is the maximum kinetic energy of the emitted photoelectrons? (Take Planck's constant h = 6.63 x 10^-34 Js and 1 eV = 1.6 x 10^-19 J)

A. 0.23 eV B. 1.73 eV C. 3 eV D. 3.23 eV

37. A radioactive sample has a decay constant of 0.02 per day. What percentage of the original sample will remain after 10 days? The initial mass of the sample is 10 grams.

A. 10% B. 20% C. 50% D. 81.87%

38. Which of the following statements **BEST** describes the distinction between conductors, semiconductors, and insulators in terms of their band gaps?

A. Conductors have a large band gap, semiconductors have a small band gap, and insulators have no band gap.
B. Conductors have no band gap, semiconductors have a small band gap, and insulators have a large band gap.
C. Conductors have a small band gap, semiconductors have no band gap, and insulators have a large band gap.
D. Conductors and semiconductors have no band gap, while insulators have a large band gap.

39.

I. It could not explain the stability of atoms.
II. It did not account for the existence of isotopes.
III. It failed to explain the discrete energy levels of electrons.
IV. It did not predict the existence of the nucleus.

Which of the above statements BEST describes the limitation of the Rutherford model of the atom?

A. I only B. II only C. III only D. IV only

40. Which of the following devices is used for rectification of alternating current (AC) to direct current (DC)?

A. Transistor B. Diode C. Capacitor D. Resistor