

# SOUTH PLAINS MATH & SCIENCE COMPETITION

## PHYSICS 1

### General Information:

- Check to see that you have written your name on the label and that the test name on the label matches the name on this booklet.
- **DO NOT** open the test booklet and **DO NOT** start until the proctor says "begin."
- Each individual exam period will be 45 minutes and each exam contains 40 multiple choice questions.
- Students are allowed to use a non-programmable battery operated calculator during the individual and team exams.
- Students are encouraged to write on the exam booklet. Scratch paper and pencils will also be provided.
- Students will not be permitted to leave the test room while the test is in progress. If a student finishes early, he/she must remain in the test room until the exam period is completed.
- If you need to ask a question during the test, raise your hand and the proctor will come to you.
- There is no penalty for skipping a problem. The exam scores will be determined by the number of correct answers. All ties will be broken by awarding the place to the contestant who has the most consecutive correct answers before a problem is missed.
- **Students may NOT keep the test booklet.**

## PHYSICS 1

- Distance is a quantity that
  - is always positive.
  - always needs a reference point.
  - has only magnitude.
  - is always a vector.
- If you were going to design a pendulum clock to work on a planet where the acceleration of gravity is only  $3.26 \text{ m/s}^2$ , how long would you have to make the pendulum for the period to be 1 second?
  - 3.26 m
  - 6.52 m
  - 0.0012 m
  - 0.0826 m
- What voltage is necessary to produce a  $300\mu\text{C}$  charge on a  $4\mu$  capacitor?
  - 0.13 V
  - 75 V
  - 4 V
  - 300 V
- A tuning fork has a 493 Hz pitch. When a second fork is struck, beat notes occur with a frequency of 16 Hz. What are the two possible frequencies of the second fork?
  - 312 Hz, 438 Hz
  - 358 Hz, 596 Hz.
  - 297 Hz, 316 Hz.
  - 477 Hz, 509 Hz.
- The energy carried by an electric current depends on which of the following?
  - the charge transferred and the potential difference
  - the potential difference
  - the total number of charges in the circuit
  - the charge transferred
- A galvanometer deflects full scale for  $80.0 \mu\text{A}$  current. You want to use it to make a voltmeter with a 10.0 V full-scale deflection. If the galvanometer has a resistance of  $2.00 \text{ k}\Omega$ , what should be the resistance of the series (multiplier) resistor?
  - 123  $\text{k}\Omega$
  - 160  $\text{k}\Omega$
  - 800  $\text{k}\Omega$
  - 8.10  $\text{k}\Omega$
- The current through a hair dryer connected to a 120 V source is 6.8 A. What power is dissipated by the hair dryer?
  - 17.64 W
  - 820 W
  - 8160 W
  - 5.66 W
- If there are five electrical devices connected in a series circuit, then the number of current paths is equal to
  - 1
  - 2
  - 3
  - 4
- The metric prefix that means 100 is
  - hecto.
  - pico.
  - centi.
  - nano.
- On a velocity - time graph, the slope of the tangent to the curve at a given point is the
  - instantaneous acceleration.
  - instantaneous velocity
  - average velocity.
  - average acceleration.
- If an object moving at a rate of 30 m/s collides with a stationary object and the two objects move away together, the velocity of the combined objects will be
  - less than  $30 \text{ m/s}$ .
  - $30 \text{ m/s}$ .
  - greater than  $30 \text{ m/s}$ .
- Water waves on a lake travel 5.3 m in 1.8 s. The period of oscillation is 1.2 s. What is the wavelength of the water waves?
  - 1.5 m
  - 2.0 m
  - 3.5 m
  - 4.25 m

13. When two objects are at thermal equilibrium
- a. they melt.
  - b. they have the same thermal energy
  - c. they contain the same amount of heat.
  - d. they are at the same temperature
14. A binary star system can be misinterpreted as a single star because
- a. the lens has a limited resolution.
  - b. a binary star system contains only one star.
  - c. the light is refracted as it enters Earth's atmosphere.
  - d. the telescope lens acts as a double slit.
15. Refraction occurs when
- a. the angle of incidence equals zero.
  - b. light strikes the boundary of two media with the same optical density.
  - c. light travels through two adjacent media with different optical densities.
  - d. the angle of reflection equals zero.
16. Only waves \_\_\_\_\_ the polarizing axis of a polarizing filter can pass through.
- a. larger than the opening of
  - b. vibrating perpendicular to
  - c. vibrating parallel to
  - d. smaller than the opening of
17. Which of the following is NOT true of plane mirrors and the images they form?
- a. The angles of reflection and incidence are equal.
  - b. The virtual image that forms is the same size as the actual object.
  - c. A virtual image is formed at the same distance behind the mirror that the object is in front of the mirror.
  - d. The light rays intersect at a point behind the mirror to form a real, smaller image.
18. An electric field is equal to
- a. force per unit charge.
  - b. force times direction.
  - c. force per unit mass.
  - d. force per unit time.
19. Absolute zero is the
- a. highest possible temperature at which materials conduct electricity.
  - b. lowest possible temperature at which materials conduct electricity.
  - c. highest possible temperature at which matter freezes.
  - d. lowest possible temperature for matter.
20. A 12.5 kg block is sliding along a frictionless surface at a speed of  $7.4 \text{ m/s}$ . What force would it take to stop the block in 8.2 seconds?
- a. 24 N
  - b. 14 N
  - c. 11 N
  - d. 21 N
21. A wagon is being pulled with the tongue of the wagon making a  $30^\circ$  angle with the ground. A force of 33 N is extended along the tongue. What is the component of the force parallel to the ground?
- a. 32 N
  - b. 36 N
  - c. 12 N
  - d. 96 N
22. During its orbital period, as a planet moves closer to the sun, the orbital velocity of the planet
- a. decreases.
  - b. remains the same.
  - c. increases

23. If an object with a velocity of  $20 \text{ m/s}$  has the same momentum as that of a  $10 \text{ kg}$  mass having a velocity of  $50 \text{ m/s}$ , the mass of the object is  
 a. greater than  $10 \text{ kg}$ .      b.  $10 \text{ kg}$ .      c. less than  $10 \text{ kg}$ .
24. For the ideal machine  
 a. input work is always less than output work.      b. efficiency would be  $100\%$ .  
 c. the mechanical advantage is always greater than 1.      d. all of these answers.
25. In going from her first class to her second a  $46.3 \text{ kg}$  student goes from the  $1^{\text{st}}$  floor to the  $3^{\text{rd}}$  floor, which is  $9.7 \text{ m}$  higher. What is the change in the student's potential energy?  
 a.  $1200 \text{ J}$       b.  $2400 \text{ J}$       c.  $4400 \text{ J}$       d.  $5600 \text{ J}$
26. The disorder in a system is known as  
 a. thermodynamics.      b. equilibrium.      c. fusion.      d. entropy.
27. The buoyant force exerted on an object immersed in a fluid is equal to  
 a. the mass of the immersed object.      b. the weight of the immersed object.  
 c. the weight of the displaced fluid.      d. the volume of the immersed object.
28. When waves spread out around the edge of a barrier, \_\_\_\_\_ occurs.  
 a. refraction      b. resonance      c. reflection      d. diffraction
29. The light from a comet takes  $6.2 \text{ s}$  to reach the Earth. How far from the Earth is the comet?  
 a.  $2.8 \times 10^5 \text{ m}$       b.  $1.9 \times 10^9 \text{ m}$       c.  $1.8 \times 10^2 \text{ m}$       d.  $3.8 \times 10^8 \text{ m}$
30. When light rays travel from an optically dense medium into a less dense medium  
 a. the refracted rays bend toward the normal.  
 b. the angle of refraction is smaller than the angle of incidence.  
 c. the rays travel more quickly.  
 d. the angle of incidence equals the angle of refraction.
31. The time required for half the atoms in any given quantity of radioactive isotope to decay is the \_\_\_\_\_ of that element.  
 a. half-activity      b. radiometric dating      c. half-life      d. ionization rate
32. A baseball, mass  $0.14 \text{ kg}$ , is thrown with a velocity of  $40 \text{ m/s}$ . Its kinetic energy is \_\_\_\_\_.  
 a.  $2.8 \text{ J}$       b.  $112 \text{ J}$       c.  $5.6 \text{ J}$       d.  $224 \text{ J}$
33. All the following phenomena can be explained if light is a wave EXCEPT  
 a. reflection.      b. photoelectric effect.  
 c. refraction.      d. diffraction.
34. A galvanometer may be used as a voltmeter by connecting a  
 a.  $0.05 \text{ ohm}$  resistor in series      b.  $5000 \text{ ohm}$  resistor in parallel  
 c.  $0.05 \text{ ohm}$  resistor in parallel      d.  $5000 \text{ ohm}$  resistor in series

35. The relationship between the pressure and volume of an ideal gas when temperature is held constant is  
 a. logarithmic.      b. inverse.      c. geometric      d. direct.
36. If the distance between two spheres of constant mass is doubled, the gravitational force between them changes from F to  
 a. 4F.      b.  $\frac{1}{4}F$ .      c. 2F.      d.  $\frac{1}{2}F$ .
37. A current of 5 amperes is flowing through a 10 ohm resistor. The voltage drop across this resistor is  
 a.  $\frac{1}{2}$  volts.      b. 15 volts.      c. 2 volts.      d. 50 volts.
38. A vibrating string 1.25 m long has a frequency of 175 hz. For this string to have a frequency of 261 hz, its length must be  
 a. 0.838 m.      b. 0.536 m.      c. 1.86 m.      d. 1.19 m.
39. When a certain force is applied to a car traveling at 36 km/h, the car is brought to rest in 8 s. If the braking force is doubled, the car will come to rest in \_\_\_\_\_  
 a. 2.5 s.      b. 7.5 s.      c. 4 s.      d. 10 s.
40. A pressure of 0.100 m of mercury (density of mercury = 13 600 2mkg; g = 9.80 2sm) is equal to:  
 a.  $1.36 \times 10E^3 N/m$       b.  $1.33 \times 10E^3 N/m^3$   
 c.  $1.36 \times 10E^4 N/m^3$       d.  $1.33 \times 10E^4 N/m^3$

**End of Test**