Lightning!

1. PHYSICS: *Short Answer:* A ball is launched at a 60° angle relative to the ground with an initial speed of 10 m/s. Neglecting air resistance, what will its horizontal displacement be after 5 seconds?

ANSWER: 25 meters

2. PHYSICS: *Short Answer:* By what factor will the angular momentum of an object change if its mass is doubled and its velocity tripled?

ANSWER: 6

3. PHYSICS: *Multiple Choice:* Which of the following regarding sound waves is false?

W) Sound waves travel through sea water faster than fresh water

X) Sound waves cannot propagate in a vacuum

Y) The speed of sound in a material can be increased by raising the temperature of the material

Z) Decreasing the frequency of a sound wave also decreases its pitch

ANSWER Y) The speed of sound in a material can be increased by raising the temperature of the material

4. PHYSICS: *Short Answer:* By name or number, denote all of the following statements that would be true for an ideal gas:

1) molecules only interact with one another when they collide

2) collisions between molecules are perfectly elastic

3) kinetic energy of the molecules is small compared to their potential energies

4) all of its internal energy is dependent on its temperature

ANSWER: 1, 2, 4

5. PHYSICS: *Short Answer:* What term is given to a gas that is cooled below its critical temperature, but has not formed a liquid surface?

ANSWER: Vapor

6. PHYISCS: *Short Answer:* By what factor will the radius of a pendulum change if its length is raised by a factor of 16?

ANSWER: 4

7. PHYISCS: *Multiple Choice:*  Which thermodynamic model best describes the processes in a gasoline-powered internal combustion engine?

W) Carnot cycle

X) Brayton cycle

Y) Otto cycle

Z) Stirlin cycle

ANSWER: Y) Otto cycle

8. PHYSICS: *Multiple Choice:* What device works via Gay-Lussac's Law to determine temperature based on the change in pressure of a gas?

W) resistance thermometer

X) alcohol thermometer

Y) mercury thermometer

Z) gas thermometer

ANSWER: Z) gas thermometer

9. PHYSICS: *Short Answer:* By what factor will the volume of a gas change if its temperature is raised by a factor of three and its pressure is halved?  
  
ANSWER: 6

10. PHYSICS: *Short Answer:* Calculate the percent efficiency of a Carnot engine that has its hot reservoir at 400 K and its cold reservoir at 80 K.  
  
ANSWER: 80%

11. PHYSICS: *Multiple Choice:* Which of the following statements most accurately describes the temperature reading of a thermometer?

W) the thermometer shows its own temperature

X) the thermometer shows the temperature of its surroundings

Y) the thermometer shows the heat content of its surroundings

Z) the thermometer shows the average kinetic energy of its surroundings

ANSWER: W) the thermometer shows its own temperature

12. PHYSICS: *Short Answer:* If g=9.8 m/s2, what is the displacement, to the nearest whole number, of a ball dropped from a height of 20 meters after 4 seconds?

ANSWER: 20 meters

13. PHYSICS: *Short Answer:* By name or number, denote all of the following statements that are true when an ideal gas is heated at constant volume

1) the gas undergoes an adiabatic process

2) the gas undergoes an isochoric process

3) ΔU = Q

4) W is negative

ANSWER: 2 and 3

14. PHYSICS: *Multiple Choice:* Under what conditions will a body's center of gravity be different than its center of mass?

W) when the body is irregularly shaped

X) when the body has a large mass

Y) when the body has variable density

Z) when the body is in a non-uniform gravitational field

15. PHYSICS: *Short Answer:* What is the coefficient of performance of a Carnot refrigerator that uses 100 Joules to pump 1000 Joules of heat out?

ANSWER 10

16. PHYSICS: *Short Answer:* Give the resultant vector of an object that has components of 10 m/s due east and 10 m/s due north  
  
ANSWER: 20 m/s at 30° east of north OR 20 m/s at 60° due north of east

17. PHYSICS: *Multiple Choice:* An electrostatic conductor will have its excess charge:

W) located on its surface

X) located outside its surface

Y) located at its centroid

Z) dispersed randomly throughout its volume

18. PHYSICS: *Multiple Choice:* Where will the image be of an object that is placed on the center of curvature of a converging mirror?

W) at infinity

X) at the focal point

Y) at the center of curvature

Z) between the center of curvature and the focal point

ABSWER Y) at the center of curvature

19. PHYSICS: *Short Answer:* What kind of corrective lenses does a farsighted person require?  
  
ANSWER: convex or converging

20. PHYSICS: *Short Answer:* This optical phenomenon, used in fiber optics, is exhibited when a beam of light's angle of incidence is greater than the critical angle when going from a medium with higher index of refraction to lower index of refraction.

ANSWER: total internal reflection

21. PHYSICS: *Multiple Choice:* Which of the following statements regarding light is not true?  
  
W) light exhibits both wave and particle properties

X) light travels in quanta called photons

Y) the visible spectrum ranges from approximately 390 nanometers to 750 nanometers

Z) double-slit diffraction is an example of light's particle nature

22. PHYSICS: *Short Answer:* Giving your answer in terms of pi, what must the length of a pendulum be to have a period of 5 seconds is the gravitational acceleration is 4 m/s2?  
  
ANSWER: 25π2 m

23. PHYSICS: *Short Answer:* By name or number, denote all of the following statements which are true for all bodies in equilibrium:

1) the sum of all forces on the body must is zero

2) the sum of all torques on the body is zero

3) the body possess no translational motion

4) the body possess no rotational motion

ANSWER: 1, 2, 3

24. PHYSICS: *Short Answer:* By name or number, denote all of the following statements which are true for a body with ballistic trajectory:  
  
1) the body follows a linear

2) the body will have the most horizontal displacement if launched at 45°

3) the body undergoes no acceleration

4) at the apex of its trajectory, the body possess no vertical velocity

ANSWER: 2, 4

25. PHYSICS: *Multiple Choice:* An 10 N block is placed on a ramp with an incline of 30°. The coefficient of static friction between the black and the surface of the ramp is 0.5. Giving your answer in simplest radical form, what is the force of friction between the ramp and block?

W) 1 N

X) N

Y) 5 N

Z) 10 N

ANSWER: Y) 5 N