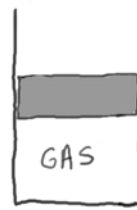


Third Exam for Physics 102, Section 1, Fall 2005

11/9/2005

1. A ball is thrown up into the air. What is the acceleration of the ball at the top of its trajectory?
 - A) 0 m/s^2
 - B) 10 m/s^2 upward
 - C) 10 m/s^2 downward
 - D) 100 m/s^2 upward
 - E) 100 m/s^2 downward
 - F) 1000 m/s^2 downward
 - G) none of the above choices are correct
2. What color should a solar water heater be for maximum heating by radiation transfer?
 - A) white
 - B) black
 - C) red
 - D) chrome-plated
 - E) none of the above choices are correct
3. In which of the following pairs of phase changes does the substance release heat in both phase changes?
 - A) Evaporation and Condensation
 - B) Condensation and Melting
 - C) Sublimation and Melting
 - D) Freezing and Condensation
 - E) Melting and Evaporation
 - F) Evaporation and Freezing
 - G) Condensation and Sublimation
 - H) none of the above answers is correct
4. Food in a pressure cooker is cooked faster because of the
 - A) higher temperature
 - B) greater rate of bubble formation in the water
 - C) increased internal energy of the water
 - D) all of the above
 - E) none of the above answers are correct
5. Which of the following statements about water is true?
 - A) When pressure increases, the boiling point is lower and the melting point is higher.
 - B) When pressure increases, the boiling point is higher and the melting point is higher.
 - C) When pressure increases, the boiling point is higher and the melting point is lower.
 - D) When pressure increases, the boiling point is lower and the melting point is lower.
6. When snow forms in clouds, the surrounding air
 - A) cools
 - B) warms
 - C) neither warms nor cools
7. In the early 1800's Sadi Carnot figured out how to calculate the maximum possible efficiency that could be achieved by any heat engine. What would the Carnot efficiency of a solar-powered heat engine be if the hot temperature were 900K (the hottest you can get with a solar parabolic dish reflector) and the cold temperature were 300K (about room temperature)?
 - A) 0
 - B) 1/3
 - C) 1/2
 - D) 2/3
 - E) 1
 - F) 300
 - G) 900
 - H) 600
 - I) none of the above choices are correct

8. The first law of thermodynamics is equivalent to what other principle?
- The second law of thermodynamics
 - Conservation of momentum
 - Newton's second law
 - Newton's third law
 - Conservation of energy**
 - The third law of thermodynamics
 - Newton's first law
 - none of the above answers are correct
9. To wholly convert a given amount of heat energy into mechanical energy is
- possible using a steam engine
 - possible using an atomic reactor
 - possible using a Stirling engine
 - possible using a gasoline engine
 - impossible regardless of the technique used**
10. The absolute zero of temperature first became apparent to scientists when they studied
- the first mercury thermometers
 - thermal expansion in solids
 - heat capacity of liquids
 - melting point of ice versus pressure
 - boiling point of water versus pressure
 - variation of gas volume versus temperature**
 - none of the above choices are correct
11. Which temperature scale is most useful to physicists because it has 0 degrees where the absolute zero of temperature really is?
- Celsius
 - Kelvin**
 - Fahrenheit
 - none of the above choices are correct
12. More efficient gasoline engines can be built if
- engines are made to rotate faster
 - a better antifreeze is developed
 - materials are developed that can withstand lower temperatures
 - materials are developed that can withstand higher temperatures**
 - none of these—they are already perfectly efficient



13. (Picture above) A volume of gas is confined in a cylinder and compressed by a heavy piston (weight 300N). When we add 1000 J of heat to the system, the gas temperature rises, the pressure in the gas increases, and the gas pushes the heavy piston upwards 1 meter. By how much has the internal energy of the gas changed?
- 1000 J
 - 700 J
 - 300 J
 - zero
 - +300 J
 - +700 J**
 - +1000 J
 - none of the above choices are correct
14. A weight suspended from a spring is seen to bob up and down over a distance of 20 cm twice each second. What is its frequency? Its period? Its amplitude?
- frequency=2 Hz, period=0.5 s, amplitude=10 cm.**
 - frequency=0.5 Hz, period=2 s, amplitude=10 cm.
 - frequency=2 Hz, period=0.5 s, amplitude=20 cm.
 - frequency=0.5 Hz, period=2 s, amplitude=20 cm.
 - none of the above are correct
15. You are shaking one end of a stretched rope, sending waves down its length. If the waves travel down the rope at 10 m/s, and the wavelength is 5 meters, what is the frequency of the oscillatory motion of your hand?
- 1 Hz
 - 2 Hz**
 - 2.5 Hz
 - 5 Hz
 - 10 Hz
 - none of the above answers are correct

16. In the above question, what is the period of the oscillatory motion of your hand?
- 0.1 second
 - 0.2 second
 - 0.4 second
 - 0.5 second**
 - 1.0 second
 - none of the above answers are correct
17. You'll need your calculator for this one: The speed of sound in air is about 344 m/s. "Middle C" on the piano makes a sound with a frequency of about 262 Hz. What is the wavelength of "middle c"?
- about 0.76 meters
 - about 1.3 meters**
 - about 7.6 meters
 - about 13 meters
 - about 76 meters
 - about 130 meters
 - none of the above answers are correct
18. You are testing out your new stereo at home. You play a test CD that sends the same exact signal, "middle c" to both speakers. You can generally hear the signal okay, but you notice that when you sit so that you are exactly the same distance from both speakers, the sound is very quiet. What physical phenomenon is being demonstrated? What brought it about?
- destructive interference, your speakers are accidentally wired "out-of-phase"**
 - destructive interference, your speakers are correctly wired "in-phase"
 - constructive interference, your speakers are accidentally wired "out-of-phase"
 - constructive interference, your speakers are correctly wired "in-phase"
 - basic stupidity, you need to hire a stereo installer
 - none of the above answers is correct
19. The siren of a fire truck sounds different when the fire truck is coming down the street towards you at high speed. The "Doppler effect" describes the change in the sound. It's due to the fact that, when the fire truck is moving rapidly towards you the
- wavelength is more, frequency is more
 - wavelength is less, frequency is more**
 - wavelength is same, speed of sound is more
 - wavelength is same, speed of sound is less
 - wavelength is more, frequency is less
 - wavelength is less, frequency is less
 - none of the above answers are correct
20. Which one is not a transverse wave?
- sound of a piano**
 - light from a star
 - waves on a lake
 - radio waves
 - vibration of guitar strings
21. The rich sound of a guitar string comes about because you hear a mixture of all the different standing waves on the string. The standing wave with the longest wavelength gives the "fundamental" frequency of the string, and the standing waves with shorter wavelengths provide the "harmonics," which make the sound rich. If the length of a guitar string is 1 meter, what is the wavelength of the "fundamental" standing wave?
- 0.1 m
 - 0.2 m
 - 0.25 m
 - 0.5 m
 - 1 m
 - 2 m**
 - 4 m
 - none of the above answers is correct
22. To say that electric charge is conserved is to say that electric charge
- may occur in an infinite variety of quantities
 - is a whole number multiple of the charge of one electron
 - will interact with neighboring electric charges
 - can be neither created nor destroyed**
 - is sometimes negative
23. In an electrically neutral atom, the number of protons in the nucleus is equal to the number of
- electrons that surround the nucleus**
 - neutrons in the nucleus
 - choices A & B are both correct
 - choices A & B are both incorrect

24. Coulomb's law has the same form as Newton's Universal Law of Gravitation. Assume we have two charged particles some distance apart. If the size of one charge is doubled and the distance between the two particles is doubled, what happens to the electrical force between them?

- A) one-fourth as large
- B) one-half as large**
- C) the same
- D) twice as large
- E) four times as large
- F) none of the above choices are correct

25. A small particle weighs 10^{-3} Newtons and is carrying a net charge of 10^{-9} Coulombs. How big does a vertical electric field need to be to balance the force of gravity so this particle can float in the air?

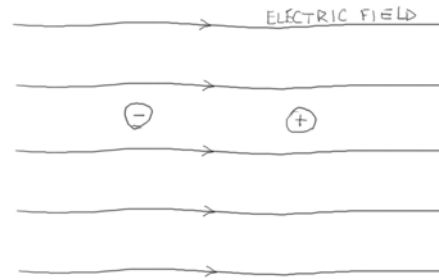
- A) 10^{-15} N/C
- B) 10^{-9} N/C
- C) 10^{-6} N/C
- D) 10^{-3} N/C
- E) 10^3 N/C
- F) 10^6 N/C**
- G) 10^9 N/C
- H) none of the above answers are correct

26. If +1 Coulomb of charge moves from an electrical potential of 200 Volts to an electrical potential of 100 Volts, how much work has been done by the electric field on that charge?

- A) zero
- B) 300 Joules
- C) 200 Volts
- D) 200 Joules
- E) 200 Coulombs
- F) 100 Volts
- G) 100 Joules**
- H) 100 Coulombs
- I) none of the above choices are correct

27. A uniform electric field \mathbf{E} is created around a hollow metal sphere (we make the symbol for the field bold to indicate that it's a vector). If a charge q is floating in the middle of the hollow metal sphere, what is the force on the charge?

- A) $-2q\mathbf{E}$
- B) $-q\mathbf{E}$
- C) $-0.5q\mathbf{E}$
- D) $0.5q\mathbf{E}$
- E) $q\mathbf{E}$
- F) $2q\mathbf{E}$
- G) none of the above answers is correct**



28. (Picture above) If you place a free electron and a free proton in the same electric field, how will the forces acting on them compare? What about their accelerations and directions of movement?

- A) proton goes left, electron goes right, proton force has larger magnitude, electron accelerates faster
- B) proton goes left, electron goes right, electron force has larger magnitude, electron accelerates faster
- C) proton goes left, electron goes right, proton force has larger magnitude, proton accelerates faster
- D) proton goes left, electron goes right, electron force has larger magnitude, proton accelerates faster
- E) proton goes left, electron goes right, proton and electron forces have equal magnitude, proton accelerates faster
- F) proton goes right, electron goes left, proton force has larger magnitude, electron accelerates faster
- G) proton goes right, electron goes left, proton and electron forces have equal magnitude, electron accelerates faster**
- H) proton goes right, electron goes left, electron force has larger magnitude, proton accelerates faster
- I) proton goes right, electron goes left, electron force has larger magnitude, electron accelerates faster
- J) none of the above answers are correct

29. A capacitor stores energy in the electric field between the two plates. If we put a sheet of polarizable material such as glass between the plates of the capacitor, what happens to the energy stored in the capacitor?

- A) it is reduced by a factor of two
- B) it decreases, but we can't say how much
- C) it stays the same
- D) it increases by a factor of two
- E) it increases, but we can't say how much
- F) none of the above answers is correct

30. Electrical current flows in wires in a way that is very similar to how water flows in pipes. In this analogy, which quantity is analogous to voltage?

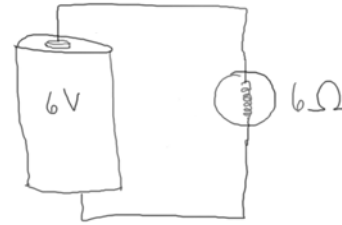
- A) water flow velocity
- B) water flow rate
- C) flow resistance
- D) water pressure
- E) water power
- F) water flow acceleration
- G) none of the above answers is correct

31. A Volt is a.

- A) Joule per Coulomb
- B) Watt times second
- C) Coulomb per second
- D) none of the above answers is correct

32. An Ampere is a.

- A) Joule per Coulomb
- B) Watt times second
- C) Coulomb per second
- D) none of the above answers is correct



33. (Picture above) A battery is connected by wires to a small light bulb. The battery supplies 6V, and the resistance of the light bulb is 6 Ohms. How much current is flowing in this circuit?

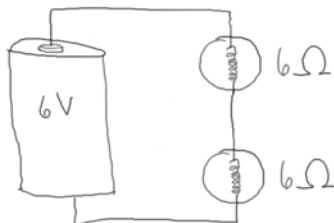
- A) 0 Amps
- B) 1/36 Amps
- C) 1/6 Amps
- D) 1 Amp
- E) 6 Amps
- F) 36 Amps
- G) none of the above answers is correct

34. In the previous question, how much power is being dissipated by the light bulb?

- A) 0 Watts
- B) 1/36 Watt
- C) 1/6 Watt
- D) 1 Watt
- E) 6 Watts
- F) 36 Watts

35. In the previous question, how much power is being supplied by the battery?

- A) 0 Watts
- B) 1/36 Watt
- C) 1/6 Watt
- D) 1 Watt
- E) 6 Watts
- F) 36 Watts



36. (Picture above) A 6V battery is connected to a series circuit consisting of two 6 Ohm light bulbs. How much current is flowing in this circuit?

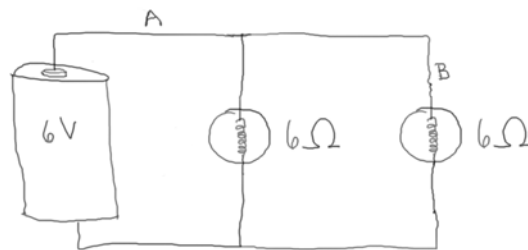
- A) 1/72 Amp
- B) 1/12 Amp
- C) 1/3 Amp
- D) 1/2 Amp**
- E) 2 Amp
- F) 3 Amp
- G) 12 Amps
- H) 18 Amps
- I) 72 Amps
- J) none of the above answers is correct

37. In the previous question, how much voltage difference is there across each light bulb?

- A) 0 Volts
- B) 1.5 Volts
- C) 3 Volts**
- D) 6 Volts
- E) 12 Volts
- F) none of the above answers is correct

38. In the previous question, how much power is being dissipated by each light bulb?

- A) 0 Watts
- B) 1.5 Watts**
- C) 3 Watts
- D) 6 Watts
- E) 9 Watts
- F) 12 Watts
- G) 36 Watts
- H) none of the above answers is correct



39. (Picture above) A 6V battery is connected to a parallel circuit consisting of two 6 Ohm light bulbs. How much current is flowing through the wire at point A?

- A) 1/12 Amp
- B) 1/6 Amp
- C) 1/3 Amp
- D) 1/2 Amp
- E) 1 Amp
- F) 2 Amp**
- G) 3 Amp
- H) 6 Amp
- I) 12 Amps
- J) none of the above answers is correct

40. In the previous question, how much current is flowing through the wire at point B?

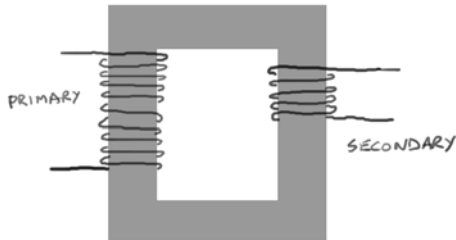
- A) 1/12 Amp
- B) 1/6 Amp
- C) 1/3 Amp
- D) 1/2 Amp
- E) 1 Amp**
- F) 2 Amp
- G) 3 Amp
- H) 6 Amp
- I) 12 Amps
- J) none of the above answers is correct

41. In the previous question, how much power is being dissipated by each light bulb?

- A) 0 Watts
- B) 1.5 Watts
- C) 3 Watts
- D) 6 Watts**
- E) 9 Watts
- F) 12 Watts
- G) 36 Watts
- H) none of the above answers is correct

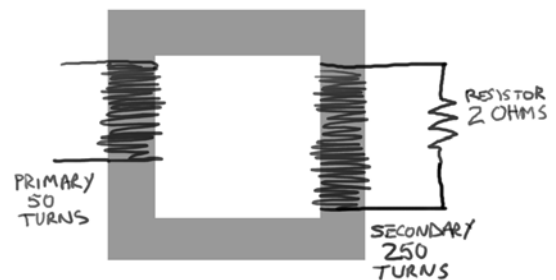
42. The source of all magnetism is
- tiny pieces of iron
 - tiny domains of aligned atoms
 - ferromagnetic materials
 - moving electric charge
 - none of the above answers is correct
43. The North Pole of a permanent magnet
- repels north poles, attracts south poles
 - repels north poles, repels south poles
 - attracts north poles, repels south poles
 - attracts north poles, attracts south poles
 - none of the above choices are correct
44. Which of the following have magnetic fields?
- a spinning wire loop
 - an electron orbiting a nucleus in an atom
 - a spinning plastic sphere
 - a magnetic domain in an iron bar
 - a proton
 - two of the above answers are correct
 - three of the above answers are correct
 - none of the above choices are correct
45. The magnetic field of a current-carrying wire
- points outward from the wire
 - points inward towards the wire
 - is wrapped around the wire
 - is parallel to the electric current
 - is anti-parallel to the electric current
 - none of the above choices are correct
46. The force on a charged particle moving through a magnetic field is
- perpendicular to the velocity of the particle
 - parallel to the magnetic field lines
 - perpendicular to the magnetic field lines
 - proportional to the charge of the particle
 - two of the above choices are correct
 - three of the above choices are correct
 - none of the above choices are correct
47. A particle with charge q and mass m is moving with velocity v through a uniform magnetic field with strength B . Over time, the speed of the particle will
- decrease, but we can't say how much
 - decrease at a rate of qvB/m
 - stay the same
 - increase, but we can't say how much
 - increase at a rate of qvB/m
 - none of the above answers is correct
48. A charged particle is moving through the magnetic field produced by an electromagnet. The magnetic force on the charged particle is F . Which of the following statements is correct?
- the particle's speed will change
 - there is a force $-F$ on the electromagnet
 - the magnetic force on the particle is parallel to the magnetic field
 - the particle's velocity will change
 - two of the above choices are correct
 - three of the above choices are correct
 - none of the above choices are correct
49. Will a pair of parallel current-carrying wires exert force on each other? How? Pick the best answer.
- The force is electrical, the wires will attract each other if the currents are parallel
 - The force is electrical, the wires will attract each other if the currents are anti-parallel
 - The force is magnetic, the wires will attract each other if the currents are parallel
 - The force is magnetic, the wires will attract each other if the currents are anti-parallel
 - The force is zero, because the wires have no net charge
 - The force is zero, because the magnetic fields of the two wires will cancel
 - none of the above answers is correct
50. We move a magnet into a coil of wire and see a peak voltage V appear across the ends of the coil. If had moved the magnet twice as fast, what would the peak voltage have been?
- one-quarter of V
 - one-half of V
 - V
 - $2V$
 - $4V$
 - none of the above choices are correct

51. An electric motor is very similar to
- A) an electric generator
 - B) an automobile battery
 - C) a radio receiver
 - D) none of the above choices is correct
52. AC power has historically been used in the nation's power grid rather than dc power because
- A) more energy is dissipated during transmission
 - B) ac voltage oscillates while dc voltage does not
 - C) ac voltage can be transformed via conventional transformers
 - D) ac circuits multiply power more easily
 - E) ac circuits are safer



53. (Picture above) We have an ideal transformer with 10 turns on the primary winding and 5 turns on the secondary winding. If we apply 120 Volts of "AC" to the primary winding, what voltage do we get across the secondary winding?
- A) 30 V
 - B) 60 V
 - C) 120 V
 - D) 240 V
 - E) 480 V
 - F) none of the above choices are correct
54. Consider the same ideal transformer as in the previous question. The transformer cannot violate conservation of energy. If the secondary winding is supplying 5 Amps of current, how much current must be going into the primary winding?
- A) 1.25 Amps
 - B) 2.5 Amps
 - C) 5 Amps
 - D) 10 Amps
 - E) 20 Amps
 - F) none of the above choices are correct

55. We have an ideal transformer with twice as many turns on the secondary winding as there are on the primary winding (this is a "step up" transformer). If a steady 12 Volts of "dc" is applied to the primary winding, what voltage do we get across the secondary winding?
- A) 3 V
 - B) 6 V
 - C) 12 V
 - D) 24 V
 - E) 48 V
 - F) none of the above choices are correct



56. (Picture above) An ideal transformer has 50 turns in its primary winding and 250 turns in its secondary winding. 10V ac is connected to the primary winding. What current is supplied by the secondary winding if a 2 Ohm resistor is connected across it?
- A) 0 Amps
 - B) 1 Amp
 - C) 5 Amps
 - D) 25 Amps
 - E) 100 Amps
 - F) 250 Amps
 - G) 500 Amps
 - H) none of the above choices are correct
57. Consider the ideal transformer of the previous question, still with 10V ac applied to the primary winding, and a 2 Ohm resistor connected across the secondary winding. What is the power supplied to the primary winding?
- A) 10 Watts
 - B) 25 Watts
 - C) 50 Watts
 - D) 125 Watts
 - E) 250 Watts
 - F) 500 Watts
 - G) 625 Watts
 - H) 1250 Watts
 - I) none of the above are correct

Scratch Paper

Scratch Paper