2007 Q31

1. James Clerk Maxwell's great contribution to electromagnetic theory was his idea that

(a) work is required to move a magnetic pole through a closed path surrounding a current.

(b) a time-changing electric field acts as a current and produces a magnetic field.

(c) the speed of light could be determined from simple electrostatic and magnetostatic experiments and finding the values of µo and εo.

(d) the magnetic force on a moving charge particle is perpendicular to both its velocity and the magnetic field.

(e) magnetism could be explained in terms of circulating currents in atoms.

2007 Q32

2.What does LASER stand for?

(a) Light Amplification by Simulated Emission of Radiation

(b) Light Amplification by Stimulated Emission of Radiation

(c) Light Amplification by Simultaneous Emission of Radiation

(d) Light Amplification by Systematic Emission of Radiation

(e) Light Amplification by Serendipitous Emission of Radiation

2007 Q47

3. Two spaceships travel along paths that are at right angles to each other. Each ship travels at 0.60c where c is the speed of light in a vacuum according to a stationary observer. If one of the ships turns on a green laser and aims it at a right angle to the direction of its travel, with what speed does the other speed record the speed of the green light?

(a) 0.40 c

(b) 0.85 c

(c) 1.00 c

(d) 1.17 c

(e) More information is required about the direction that the light is traveling in order to answer the question.

2007 Q48

4. How fast must an observer move so that a stationary object appears to be one-half of its proper length?

(a) 0.50 c

(b) 0.67 c

(c) 0.75 c

(d) 0.87 c

(e) 0.93 c

2007 Q49

5. The ratio λ1/λ2 of the deBroglie wavelengths of two non-relativistic particles with masses m1 and m2 and the same kinetic energy, is equal to

(a) m2/ m1

(b) m1/ m2

(c) 2 / mm 1

(d) 1 / mm 2

(e) 1

2007 Q50

6. A gas undergoes radioactive decay with time constant τ. A sample of 10000 particles is put into a container. After one time constant has passed, the experimenter places another 10000 particles into the original container. How much time passes from the addition of the particles until the container of gas reaches 10000 total particles again?

(a) (0.405) τ

(b) (0.500) τ

(c) (0.693) τ

(d) τ

(e) 2τ

2008 Q25

7. The following nuclear reaction occurs: . What is ?

(A) a proton

(D) an alpha particle

(B) an electron

(E) a neutron

(C) a positron

2008 Q26

8. If the principal quantum number of an electron is 4 =n , how many possible values of the orbital magnetic quantum number l m are there for this electron?

(A) 3

(B) 4

(C) 7

(D) 9

(E) 16

2008 Q32

9. On February 20, 2008, there was a total lunar eclipse. What was the phase of the Moon during the eclipse?

(A) New Moon

(D) Last Quarter

(B) Full Moon

(E) First Quarter

(C) Dark Moon

2008 Q45

10. Electron #1 moves with speed 0.30c where c is the speed of light. Electron #2 moves with speed 0.60c. What is the ratio of the kinetic energy of electron #2 to electron #1?

(A) 1.19

(B) 1.32

(C) 2.00

(D) 4.00

(E) 5.18

2008 Q47

11. A radioactive sample decays with a half-life of 2.0 yr . Approximately how much time must pass so that only 1/3 of the original sample remains?

(A) 6.0 yr

(B) 3.4 yr

(C) 3.2 yr

(D) 3.0 yr

(E) 2.8 yr

2009 Q30

12. In terms of the seven fundamental SI units in the MKS system, the Ohm is written as

(A)

(B)

(C)

(D)

(E)

2009 Q50

13. What is the magnitude of the linear momentum (in units of ) of an electron moving in a

straight line if it has 3.2 x 10-13 J of kinetic energy?

(A) 0

(B) 2.6 x 10-22

(C) 7.6 x 10-22

(D) 1.3 x 10-21

(E) 1.9 x 10-12

2010 Q36

14. In terms of the seven fundamental SI units in the MKS system, the unit for capacitance is written as which of the following?

(A)

(B)

(C)

(D)

(E)

2010 Q44

15. A radioactive sample of gas has a half-life of 100 seconds. If there are initially 10000 of these gas molecules in a closed container, approximately how many of the molecules remain after a time of 250 seconds elapses?

(A) 2500

(B) 2190

(C) 1770

(D) 1560

(E) 1250

2010 Q46

16. For the following nuclear reaction, what is the unknown labeled by X ?

(A) A proton

(B) An electron

(C) A neutron

(D) An alpha particle

(E) A positron

2010 Q48

17. Which of the following wavelengths (in nm) of electromagnetic radiation will produce photoelectrons of the least kinetic energy if the radiation is incident on a material with a work function of 4.80 eV?

(A) 992

(B) 496

(C) 248

(D) 124

(E) 62

2010 Q50

18. An object of mass m is initially at rest. After this object is accelerated to a speed of 2.40 x 108 m/s , it collides with and sticks to a second object of mass m at rest. Immediately after the collision, what is the common speed of the two masses?

(A) 2.25 x 108 m/s

(B) 1.80 x 108 m/s

(C) 1.66 x 108 m/s

(D) 1.50 x 108 m/s

(E) 1.20 x 108 m/s

2011 Q 21

19. Which one of the following choices best represents the time it takes for light coming from the Moon’s surface to reach the Earth?

(A) 0.001 s

(B) 0.10 s

(C) 1.0 s

(D) 10.0 s

(E) 1 minute

2011 Q25

20. The product (3 Teslas)×(2 meters)×(4 meters/second) is equivalent to which one of the following?

(A) 24 Amperes

(B) 24 Coulombs

(C) 24 Watts

(D) 24 Ohms

(E) 24 Volts

2011 Q26

21. During the New Moon phase of the lunar cycle, approximately what percent of the Moon’s surface receives light from the Sun?

(A) 0 %

(B) 25.0 %

(C) 50.0 %

(D) 75.0 %

(E) 100 %

2011 Q50

22. A person sets a one-meter long stick so that it makes a 30° angle with the x-axis. An observer in a space ship moving along the x-axis measures the angle of the stick to be 60° with the x-axis. With what speed is the space ship moving in terms of the speed of light, c?

(A)

(B)

(C)

(D)

(E)

2012 Q21

23. A child’s balloon is filled with pure Xenon gas. This balloon then is released from rest two meters above the ground on Earth. Which one of the following choices best describes the response of the balloon?

(A) The balloon immediately falls toward the ground.

(B) The balloon floats gently in the air, finally reaching the ground after several minutes.

(C) The balloon floats gently in the air, essentially hovering at the same height for at least a day.

(D) The balloon very, very slowly and gently rises upward.

(E) The balloon rapidly rises into the sky.

2012 Q32

24. To whom was the first Nobel Prize in physics awarded?

(A) Isaac Newton for his contributions to physics and calculus.

(B) James Chadwick for the discovery of the neutron.

(C) Wilhelm Röntgen for the discovery of X-rays.

(D) Marie Curie for her work in radioactivity.

(E) Albert Einstein for his explanation of the photoelectric effect and for the theories of relativity.

2012 Q37

25. The cylindrical head of an aluminum nail has a diameter of 1.00cm. For the top layer of atoms in the nail’s head, which one of the following choices best represents the number of aluminum atoms in that layer?

(A) 1010

(B) 1015

(C) 1020

(D) 1025

(E) 1030

Questions 26 and 27 deal with the following information:

A hypothetical radioactive substance Aaptinium decays via alpha-emission into Physicsbowlium. The decay constant for this alpha-emission is 20s-1.

2012 Q41

26. Which one of the following statements correctly compares Physicsbowlium to Aaptinium?

(A) Physicsbowlium has 4 fewer protons and 2 fewer neutrons than Aaptinium.

(B) Physicsbowlium has 4 fewer neutrons and 2 fewer protons than Aaptinium.

(C) Physicsbowlium has 2 fewer protons and 2 fewer neutrons than Aaptinium.

(D) Physicsbowlium has 4 fewer protons than, and the same number of neutrons as, Aaptinium.

(E) Physicsbowlium has 2 fewer protons than, and the same number of neutrons as, Aaptinium.

2012 Q42

27. What is the half-life of Aaptinium?

(A) 0.035s

(B) 0.050s

(C) 0.100s

(D) 0.297s

(E) 0.693s

2012 Q45

28. A stationary atom of mass 4.00 x 10-26 kg spontaneously emits a photon of energy 10.0eV. Which one of the following choices best represents the speed, in units of m/s, of the atom after emitting the photon?

(A) 4.00 x 107

(B) 8.94 x 103

(C) 1.33 x 10-1

(D) 1.58 x 10-4

(E) 2.50 x 10-8

2012 Q46

29. There is a quantity called the Planck time, tPlanck, which is computed in terms of constants as where h is Planck’s constant divided by 2π, G is the Universal Gravitational Constant, and c is the speed of light. In order for this expression for time to be consistent, what is the numerical value of , the power to which the speed of light is raised?

(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

2013 Q21

30. The following nuclear reaction occurs: . What is ?

(A) a neutron

(B) a proton

(C) a positron

(D) an alpha particle

(E) an electron

2013 Q24

31. Which one of the following statements best describes Huygens’s Principle?

(A) An additional pressure is transmitted undiminished to all points in the fluid and to the walls of the container.

(B) Each point on a wavefront acts as a source of secondary spherical wavelets (new waves).

(C) For every action force, there is an equal but opposite reaction force.

(D) It is impossible to have a process which has the sole result of transferring energy from a low temperature reservoir to a high temperature reservoir.

(E) A time-changing magnetic field has an associated induced electric field.

2013 Q34

32. Which one of the following choices represents the base MKS units for sound intensity?

(A)

(B)

(C)

(D)

(E)

2013 Q36

33. The principal quantum number of an electron is n = 5. How many possible values of the orbital magnetic quantum number m1 are there for this electron?

(A) 25

(B) 11

(C) 9

(D) 5

(E) 4

2013 Q44

34. Which one of the following terms/quantities is most closely associated with “the measure of the resistance of an object to length change under lengthwise tension or compression.”?

(A) Bulk modulus

(B) Plastic deformation

(C) Shear modulus

(D) Elastic limit

(E) Young’s modulus

2013 Q46

35. Which one of the following quarks was the last to be confirmed experimentally?

(A) Charmed

(B) Up

(C) Strange

(D) Down

(E) Top

2013 Q47

36. Which one of the following choices best represents the magnitude of the angular momentum of the Earth (expressed in base MKS units) associated with its rotation about its axis?

(A) 1038

(B) 1034

(C) 1030

(D) 1026

(E) 1022

2013 Q49

37. Two electrons move with the magnitude of their linear momentum having a ratio of 2:1. If the slower electron moves with a speed of 1.20 x 108 m/s, what is the speed of the faster moving electron?

(A) 2.67 x 108 m/s

(B) 2.40 x 108 m/s

(C) 2.24 x 108 m/s

(D) 1.97 x 108 m/s

(E) 1.56 x 108 m/s

2014 Q30

38. Considering only the Moon-Earth system (ignore any influence of the Sun), which one of the following best expresses the magnitude of the Moon’s acceleration about the Earth?

(A) 3×10−1 𝑚/𝑠2

(B) 3×10−2 𝑚/𝑠2

(C) 3×10−3 𝑚/𝑠2

(D) 3×10−4 𝑚/𝑠2

(E) 3×10−5 𝑚/𝑠2

2014 Q32

39. Planck’s constant is multiplied by the speed of light. The resulting value then is divided by three meters. This final value has the units of which one of the following quantities?

(A) Force

(B) Linear Momentum

(C) Speed

(D) Frequency

(E) Energy

2014 Q35

40. There are several statements presented below that attempt to describe physical phenomena. Which one of the following statements is correct?

(A) The coefficient of friction is a value always less than or equal to one, but greater than or equal to zero.

(B) For horizontal surfaces, the normal force acting on an object always cancels the gravitational force.

(C) An ideal gas’s temperature must change if both work is done and energy is exchanged as heat with it.

(D) Increasing the spacing between slits in the Young’s double slit experiment results in an increase in the spacing between the dark regions on a distant viewing screen.

(E) In electrostatic equilibrium, an electric field is perpendicular to the surface of a charged conductor.

2014 Q41

41. “No two electrons in an atom can have an identical set of the four quantum numbers.” is a statement most closely associated with which one of the following scientists?

(A) Albert Einstein

(B) Enrico Fermi

(C) Sheldon Cooper

(D) Wolfgang Pauli

(E) Isaac Newton

2014 Q50

42. Two clocks, A and B, are synchronized on Earth. Clock A is placed onto a space ship that leaves Earth in a straight line with a speed of 2.40×108 𝑚/𝑠 . On Earth, a scientist with clock B has her telescope fixed directly on clock A. If each clock started at 𝑡 = 0𝑠, what time does the scientist observe on clock A when clock B reads 𝑡 = 90𝑠? Assume the time of acceleration for the ship leaving the Earth was negligible.

(A) 24 𝑠

(B) 30 𝑠

(C) 50 𝑠

(D) 54 𝑠

(E) 72 𝑠

2015 Q31

43. Approximately how many hydrogen atoms are there in the liquid water of Earth’s oceans?

(A) 1062

(B) 1057

(C) 1052

(D) 1047

(E) 1042

2015 Q37

43. Which one of the following choices represents the base SI units of inductance?

(A)

(B)

(C)

(D)

(E)

2015 Q44

44. Which one of the following choices is most associated with the following statement: “When the pressure of a gas is held constant, the volume of the gas is directly proportional to the temperature.” ?

(A) Newton’s Law

(B) Boyle’s Law

(C) Avogadro’s Law

(D) Graham’s Law

(E) Charles’s Law

2015 Q49

45. The kinetic energy associated with an electron is twice its rest energy. At what speed is the electron traveling?

(A) 2.83 ×108 𝑚/𝑠

(B) 2.67×108 𝑚/𝑠

(C) 2.60×108 𝑚/𝑠

(D) 2.25×108 𝑚/𝑠

(E) 2.12×108 𝑚/𝑠