Some Multiple Choice problems from the test bank used to construct the 1404 Final
Note that questions in Sample Test – 1 were from this file - so only Chpt 20-31 are included here.

1) Two long parallel wires carry equal currents. The magnitude of the force between the wires is F. The current in each wire is now doubled. What is the magnitude of the new force between the two wires?
A) 4F  B) 2F  C) F/4  D) F/2

2) In a mass spectrometer a particle of mass m and charge q is accelerated through a potential difference V and allowed to enter a magnetic field B, where it is deflected in a semi-circular path of radius R. The magnetic field is uniform and oriented perpendicular to the velocity of the particle. A correct expression for the mass of the particle is $M = \frac{qB^2R^2}{V}$.
A) $qB^2R^2/V$  B) $qB^2R^2/(2V)$  C) $q^2B^2R^2/V$  D) $q^2B^2R^2/(2V)$

3) What is the force per meter on a straight wire carrying 5.0 A when it is placed in a magnetic field of 0.020 T? The wire makes an angle of 27° with respect to the magnetic field lines.
A) 0.022 N/m  B) 0.045 N/m  C) 0.17 N/m  D) 0.26 N/m

4) A transformer is a device used to
A) transform an alternating current into a direct current.  B) transform a direct current into an alternating current.  C) increase or decrease an ac voltage.  D) increase or decrease a dc voltage.

5) A circular loop of radius 0.10 m is rotating in a uniform magnetic field of 0.20 T. Find the magnetic flux through the loop when the plane of the loop and the magnetic field vector are perpendicular.
A) zero  B) $3.1 \times 10^{-3}$ T·m²  C) $5.5 \times 10^{-3}$ T·m²  D) $6.3 \times 10^{-3}$ T·m²

6) A coil is wrapped with 200 turns of wire on a square frame with sides 18 cm. A uniform magnetic field is applied perpendicular to the plane of the coil. If the field changes uniformly from 0.50 T to 0 in 8.0 s, find the average value of the induced emf.
A) 2.1 mV  B) 4.1 mV  C) 0.21 V  D) 0.41 V

7) The index of refraction of diamond is 2.42. This means that a given frequency of light travels
A) 2.42 times faster in air than it does in diamond.  B) 2.42 times faster in diamond than it does in air.  C) 2.42 times faster in vacuum than it does in diamond.  D) 2.42 times faster in diamond than it does in vacuum.

8) An image is 4.0 cm behind a concave mirror with focal length 5.0 cm. Where is the object?
A) 2.2 cm in front of the mirror  B) 2.2 cm behind the mirror  C) 9.0 cm in front of the mirror  D) 1.0 cm behind the mirror

9) Light passes from air to water. The incoming ray is at an angle of 17.0° to the normal. The index of refraction is 1.33. What is the angle in the water?
A) 22.9°  B) 22.6°  C) 18.3°  D) 12.7°

10) Electromagnetic waves are
A) longitudinal.  B) transverse.  C) both longitudinal and transverse.  D) neither longitudinal or transverse.

11) A radar receiver indicates that a transmitted pulse return as an echo in 20 μs after transmission. How far away is the reflecting object?
A) 1.5 km  B) 3.0 km  C) 6.0 km  D) 9.0 km

12) What is the wavelength of a 92.9-MHz radio wave?
A) 32 mm  B) 32 cm  C) 3.2 m  D) 32 m
13) Two beams of coherent light travel different paths arriving at point P. If the maximum destructive interference is to occur at point P, the two beams must
A) travel paths that differ by a whole number of wavelengths.
B) travel paths that differ by an odd number of half-wavelengths.

14) Monochromatic light is incident on a grating that is 75 mm wide and ruled with 50,000 lines. The second-order maximum is seen at 32.5°. What is the wavelength of the incident light?
A) 202 nm  B) 403 nm  C) 605 nm  D) 806 nm

15) Relative to a stationary observer, a moving clock
A) always runs slower than normal.  B) always runs faster than normal.  C) keeps its normal time.  D) can do any of the above. It depends on the relative velocity between the observer and the clock.

16) During a reaction, $1.7 \times 10^{-4}$ J of energy is released. What change of mass would cause this?
A) $5.1 \times 10^{-4}$ kg  B) $1.5 \times 10^{-13}$ kg  C) $4.8 \times 10^{-18}$ kg  D) $1.9 \times 10^{-21}$ kg

17) A spaceship moves away from the Earth with a speed of 0.80c. The spaceship then fires a missile with a speed of 0.50c relative to the spaceship. What is the velocity of the missile measured by observers on the Earth if the missile is fired toward the Earth?
A) 0.30c  B) 0.50c  C) 0.93c  D) 1.3c

18) What is a photon?
A) an electron in an excited state  B) a small packet of electromagnetic energy that has particle-like properties  C) one form of a nucleon, one of the particles that makes up the nucleus  D) an electron that has been made electrically neutral

19) What frequency of electromagnetic radiation has an energy of 58.1 μeV?
A) 1.4 MHz  B) 711 MHz  C) 7.1 GHz  D) 14 GHz

20) An electron is accelerated by a potential difference of 100 V. What is its wavelength?
A) 0.122 nm  B) 0.212 nm  C) 0.221 nm  D) 0.313 nm

21) The orbital quantum number can have any integer value ranging from
A) 0 to n.  B) 0 to (n-1).  C) 1 to n.  D) 1 to (n+1).

22) In the ground state, the quantum numbers ($n$, $l$, $m_l$, $m_s$) for hydrogen are, respectively,
A) 1, 1, 1, 1.  B) 1, 0, 0, 0.  C) 1, 0, 0, ±1/2.  D) 1, 1, 1, ±1/2.

23) Suppose that the speed of an electron traveling 2000 m/s is known to an accuracy of 1 part in $10^5$ (i.e., within 0.001%). What is the greatest possible accuracy within which we can determine the position of this electron?
A) 2.9 mm  B) 5.8 mm  C) 8.7 mm  D) 1.2 cm

24) A proton strikes an oxygen-18 nucleus producing fluorine-18 and another particle. What other particle is produced by this nuclear reaction?
A) a neutron  B) an alpha particle  C) an β⁻ particle  D) an β⁺ particle
25) Find the Q value of the following reaction:

\[ ^{14}_{7} N + ^{4}_{2} He \rightarrow ^{17}_{8} O + ^{1}_{1} H \]

\((14.003074 \text{ u}) \quad (4.002603) \quad (16.999131 \text{ u}) \quad (1.007825 \text{ u})\)

A) -0.001279 u  B) -0.002179 u  C) -0.007219 u  D) -0.009721 u

26) An α particle is also known as
A) an electron.  B) a positron.  C) a helium nucleus.  D) a photon.

27) An atom has 98 protons and 249 nucleons. If it undergoes alpha decay, what are the number of protons and neutrons, respectively, in the daughter nucleus?
A) 100, 245  B) 94, 247  C) 96, 245  D) 100, 249