Example Questions for Quiz 4 – Solutions
(covering Chapters 6 and part of 7 – Electricity and Light)

Here are some questions that are similar to what will be on Quiz 4.
The quiz will have a total of 20 points selected from these possibilities.
As always, you may use your equation and symbol sheets.

1. (2 points) Opposite charges (**attract**, ~~repel~~) and like charges (~~attract~~, **repel**).

2. (2 points) The force between charges is (**directly**, ~~inversely~~) proportional to the charges and (~~directly~~, **inversely**) proportional to the square of their separation. This is called Coulomb's Law and is very much like Newton's Law of Gravitation except that charges can be positive and negative while masses are always positive.

3. (1 points) An electron has a (~~positive~~, **negative**) charge.

4. (1 points) The nuclei of atoms have a (**positive**, ~~negative~~) charge.

5. (2 points) Some objects hold on to their electrons more strongly than others so rubbing two different objects together is one way to create an electric __**charge**__ difference.

6. (2 points) When water breaks into droplets, the droplets are likely to have unbalanced __**charges**__.

7. (2 points) Charges are surround by an __**electric**__ field.

8. (2 points) Electric field lines start at (**positive**, ~~negative~~) charges and end at (~~positive~~, **negative**) charges. (In either case, those charges might be located so far away they are considered to be at infinity.)

9. (2 point) Like magnetic poles (~~attract~~, **repel**) each other while unlike poles (**attract**, ~~repel~~) each other.

10. (1 points) When magnets are divided, one can have separate north and south poles. (~~true~~, **false**)

11. (1 points) The north geographic pole of the earth is near its north magnetic pole. (~~true~~, **false**)

12. (1 points) Magnetic field lines always form closed loops. (**true**, ~~false~~)

13. (1 points) Magnetic north and south poles always come in matched pairs (**true**, ~~false~~)

14. (1 points) A "conventional current" is one flowing from (**positive to negative**, ~~negative to positive~~) contacts.

15. (2 points) A wire carrying an electric current produces __**magnetic**__ field rings around it.

16. (2 points) Certain materials like iron have microscopic magnetic clusters called __**domains**__.

17. (2 points) A charge in an electric field feels a __**force**__ proportional to the size of the charge and the strength of the electric field.

18. (2 points) In the presence of the magnetic field from a wire coil wound around an iron core, the randomly oriented __**domains**__ in the iron become aligned and produce an enhanced magnetic field.

19. (4 points) A moving magnet produces a/an __**electric**__ field around it which can move __**electrons**__ in a wire coil thereby producing an electric __**current**__ which then produces an opposing __**magnetic**__ field.

20. (4 points) A changing magnetic field produces a/an __**electric**__ field around it which can move __**electrons**__ in a wire coil thereby producing an electric __**current**__ which then produces an opposing __**magnetic**__ field.

21. (2 points) Charges moving in a magnetic field feel a __**sideways**__ force proportional to their velocity and to the magnetic field strength.

22. (2 points) A changing electric field produces a changing __**magnetic**__ field around it. This is very difficult to demonstrate directly, but makes electromagnetic waves possible.

23. (2 points) Electromagnetic waves travel at the speed of __**light**___.

24. (14 points; this has too many points for a quiz, but might appear on a test!) Fill in the blanks in the following two paragraphs with the correct words chosen from the following list: **negative negatively positive positively top bottom moist sun updraft downdraft**

The ___**sun**____ heats some parts of the earth more than other parts causing an __**updraft**___ which carries __**moist**__ air up to high altitudes where it condenses forming thunderclouds. Within the clouds charges become separated and _**positively**_charged lighter ice crystals or water droplets are carried to the ___**top**___ of the cloud. _**negatively**_ charged heavier ice crystals or water droplets accumulate near the __**bottom**__ of the clouds.

The earth is _**negatively**_ charged, but less so than the __**bottom**__ of the clouds setting the conditions for lightning which will allow a _**negative**__ current flow from the _**bottom**__ of the cloud to the earth.

The _**positive**___ charges at the ___**top**___ of the clouds spread through a wide region distant from the thunderstorm and cause the "fair weather electric field" of 100 V/m. That electric field causes a _**positive**__ current from the upper atmosphere to flow to the earth completing the atmospheric electric current loop.

25. (1 points) In the water dropper demonstration, the aluminum foils pulled together because they had (~~the same~~, **opposite**) charges.

26. (1 points) A capacitor is two pieces of metal that have (~~the same~~, **opposite**) charges.

27. (4 points) An ideal transformer with 100 turns in its primary winding and 500 turns in its secondary winding is connected to 120 VAC. How much voltage will appear in its secondary winding?

$$\frac{(\textbf{primary voltage})}{(\textbf{primary loops})}=\frac{(\textbf{secondary voltage})}{(\textbf{secondary loops})} \quad \textbf{or} \quad \frac{V_p}{N_p}=\frac{V_s}{N_s} \quad \textbf{so} \quad V_s=\frac{N_s}{N_p}V_p=\frac{500\,\textbf{turns}}{100\,\textbf{turns}}\cdot 120\,\textbf{V}=600\,\textbf{V}$$

28. (4 points) An ideal transformer with 100 turns in its primary winding and 5 turns in its secondary winding is connected to 120 VAC. How much voltage will appear in its secondary winding?

$$\frac{(\textbf{primary voltage})}{(\textbf{primary loops})}=\frac{(\textbf{secondary voltage})}{(\textbf{secondary loops})} \quad \textbf{or} \quad \frac{V_p}{N_p}=\frac{V_s}{N_s} \quad \textbf{so} \quad V_s=\frac{N_s}{N_p}V_p=\frac{5\,\textbf{turns}}{100\,\textbf{turns}}\cdot 120\,\textbf{V}=6\,\textbf{V}$$

29. (1 points) An ideal transformer can provide more power at its output as is delivered to its input. (~~true~~, **false**)

30. (1 point) When a bar magnet is resting inside of a coil, no electric current is produced. (**true**, ~~false~~)

31. (1 point) Moving a magnet near a wire coil is one way of generating an electric field and therefore an electric current. (**true**, ~~false~~)

32. (1 point) A sound wave is an electromagnetic wave. (~~true~~, **false**)

33. (1 point) A radio wave is an electromagnetic wave. (**true**, ~~false~~)

34. (1 point) Infra-red rays are electromagnetic waves. (**true**, ~~false~~)

35. (1 point) Ultra-violet rays are electromagnetic waves. (**true**, ~~false~~)

36. (1 point) Gamma rays are electromagnetic waves. (**true**, ~~false~~)

37. (1 point) Water waves are electromagnetic waves. (~~true~~, **false**)

38. (1 point) Light waves are electromagnetic waves. (**true**, ~~false~~)

39. (4 points) An electromagnetic wave has a frequency of 10^{14} Hz. What is its wavelength?

$$c = \lambda f \quad \textbf{so} \quad \lambda = \frac{c}{f} = \frac{299792458\,\text{m/s}}{10^{14}\,\text{Hz}} \approx \frac{3.00\times10^{8}\,\text{m/s}}{10^{14}\,\text{Hz}} \approx 3.00\times10^{-6}\,\text{m} \approx 3.00\,\mu\,\text{m}$$

40. (4 points) An electromagnetic wave has a wavelength of 1.00 m. What is its frequency?

$$c = \lambda f \quad \textbf{so} \quad f = \frac{c}{\lambda} \approx \frac{3.00\times10^{8}\,\text{m/s}}{1.00\,\text{m}} \approx 3\times10^{8}\,\text{Hz} \approx 300\,\text{MHz}$$

41. (2 points) Microscopes and telescopes both are limited by (**diffraction**, ~~reflection~~, ~~refraction~~) of light.

42. (1 points) In a pinhole camera and our eyes, the image is (~~right-side up~~, **upside down**).

43. (2 points) Normal human eyes can adjust their focus from (~~0.1~~, **0.25**, ~~0.5~~, ~~1.0~~) m to infinity.

44. (1 point) Light is electric and magnetic fields pulling each other through space. (**true**, ~~false~~)

45. (2 points) When hot objects emit light it is called __**blackbody**__ radiation.

46. (1 point) A smooth surface produces (~~diffuse~~, **specular**) reflection of light.

47. (1 point) A rough surface produces (**diffuse**, ~~specular~~) reflection of light.

48. (1 points) Light travels (**faster**, ~~slower~~) in warm air than in cold air.

49. (2 points) When we see the sun at the horizon, it is actually (~~above~~, **below**, ~~at~~) the horizon.

50. (1 point) Sunsets and sunrises are reddish because the blue colors have been scattered to land beyond the horizon leaving only the reddish light for us to see. (**true**, ~~false~~)

51. (1 point) The sky (away from the sun) is blue because the atmosphere above us scatters the blue light toward us letting reddish light go elsewhere. (**true**, ~~false~~)