

Quiz 2; Phys 100

Name _____

1. (4 points) In a crash test, a 1000 kg automobile moving at 10 m/s crashes into a brick wall. How much energy goes into demolishing and heating the wall and the auto?

Answer: All the kinetic energy of the car will be converted into the energy going into heating and demolishing the wall and car (plus sound, which we ignore). So $\frac{1}{2}mv^2 = \frac{1}{2}(1000 \text{ kg})(10 \text{ m/s})^2 = 50\,000 \text{ J}$.

2. (3 points) For an object freely falling to Earth, which of the following is true, ignoring air resistance?

- (a) Its kinetic, gravitational, and total energies all increase.
- (b) Kinetic energy increases, gravitational decreases, the total remains constant.**
- (c) Kinetic energy decreases, gravitational increases, the total remains constant.
- (d) None of its energies change: they all remain constant.
- (e) Kinetic, gravitational, and total energy all decrease.

3. (3 points) Since matter is made of electrically charged particles, why don't we and the objects around us feel electric forces all the time?

- (a) Constituents of objects have opposite charges, adding up to electric neutrality overall.**
- (b) The charges need to be activated before we see any effect; normal matter is inert.
- (c) The electric forces are cancelled out by the magnetic forces.
- (d) We *do* feel these forces: that is where gravity comes from.
- (e) Since these forces act in all directions, they push as often as pull, cancelling out.

4. (3 points) Which of the following is *not* an example of electromagnetic waves?

- (a) Radio waves
- (b) Microwaves
- (c) Visible light
- (d) Sound waves**
- (e) X-rays

5. (3 points) Red light has a longer wavelength than blue light. How, then, does the frequency of red light compare to the frequency of blue light? Explain.

Answer: The speed of light is constant. And for any wave, speed is wavelength times frequency. To keep the speed the same, if one goes up, the other must go down. Therefore, the frequency of red light must be *smaller* than that of blue light.

6. (4 points) Give an example that, according to Neil DeGrasse Tyson, is evidence for the universality of physical law. (*Not* his whipped cream floating to the top!)

Answer: Answers will vary, but might include:

- Same sorts of atomic spectra observed throughout the universe.
- Gravity applying the same way to binary stars and binary galaxies.
- Physical constants being the same everywhere observed.