

UVU PS1000 Midterm **NAME:** _____

PART 1 MULTIPLE CHOICE - check the answer that is correct

1. Do heavier objects fall faster than lighter ones and why?(neglecting air drag)

- No, lighter objects fall faster because they accelerate more quickly.
- Yes, the heavier one has a greater force of gravity acting on it.
- No, they have the same force of gravity acting on them.
- No, they have the same accelerations.

2. Which two of the four fundamental forces do we deal with most in our daily lives?

- electromagnetic and gravitational
- gravitational and nuclear
- electromagnetic and quintessence
- nuclear strong and nuclear weak

3. You throw a baseball up into the air. What is the baseball's acceleration at the top of its flight?

- Zero
- $9.8 \frac{\text{ft}}{\text{s}^2}$
- $32 \frac{\text{m}}{\text{s}^2}$
- $9.8 \frac{\text{m}}{\text{s}^2}$

4. What is the equivalence principle?

- The physical quantities, mass, and weight are equivalent throughout the universe
- Each massive particle has a corresponding massless partner particle
- The dimension of mass is measured in Newtons
- An object's gravitational mass and inertial mass are equal

5. How is Coulomb's law for electromagnetic force similar to Newton's Law for gravitational force?

- They are both apply to nuclear forces.
- They both use the inverse square law.
- Their constants are the same.
- They are both in direct proportion to distance.

6. What is true about a magnet?

- A magnet can never be found in nature.
- A magnet attracts anything that is metal.
- Magnets are really just sources of gravitational fields.
- Only materials that are ferromagnetic can be magnetized.

7. What is true about air resistance?

- A falling body will reach a constant velocity
- Terminal velocity keeps increasing as you fall
- Air resistance is negligible in any situation on earth
- A falling body will not reach a constant velocity

8. To decrease the pressure caused by a force, how must you change the area to which it's applied?

- decrease the area
- increase the area
- start a lawn mower
- increase the pressure

9. When does something float above the surface of a fluid?

- when it is more dense than the surrounding fluid
- when it weighs less than an equal volume of fluid
- when it is not porous
- when it has less mass than all the fluid

10. If I shoot a 1 pound ball at 100 mph with a 50 pound gun, how fast will the gun initially move back when the bullet is fired?

- 4 mph
- .5 mph
- 2 mph
- 0 mph

11. When a diver tucks in to a fetal position he will begin to flip around faster. This is an example of conservation of...

- Linear momentum
- Angular momentum
- Energy
- Charge

12. What type of heat transfer occurs when you touch a hot surface?

- Conduction
- Convection
- Radiation
- Ultraviolet catastrophe

13. What equation correctly describes mass changing form into radiant energy?

- $E = m^2c^2$
- $E = mc^2$
- $E = (mc)^2$
- $E = mc$

14. Sound travels at about .2 miles per second. If you hear thunder 7 seconds after seeing lightning, about how many miles away is the lightning?

- 14 miles
- 1.4 miles
- 35 miles
- 140 miles

15. What is true about diffraction?

- A wave diffracts much more when the incoming wavelength is much smaller than the opening.
- Approaching the angle of total internal reflection reveals evanescent waves.
- A wave diffracts much more when the incoming wavelength is about the same size as the opening.
- A wave diffracts much more when the incoming wavelength is much greater than the opening.

16. Why is light both like a wave and a particle?

- It frees electrons on a metal instantly but can diffract around corners.
- It is actually particles that wave up and down and move at the speed of light.
- It turns into a particle when interacting with massive particles.
- Quantum jumps of light record the birth and death of a photon in a cavity.

17. How are you able to cool soup by blowing on it?

- The soup absorbs the cold air from your lungs.
- It is a myth, you cannot cool soup off by blowing on it.
- You are increasing the pressure in the middle of the soup so some soup drips off the edge of the bowl onto the table.
- The hottest soup molecules just released from the surface can be blown away to make room for the next hottest.

18. Temperature is a measure of...

- the number of particles in a system
- the average kinetic energy of molecules
- the rate of change of chemical reactions
- heat flow in the room

19. Why does water expand when it freezes?

- It actually does not expand when it freezes, it only expands at around 4 C⁰.
- The relative kinetic energy of the water molecules is low enough for hydrogen bonds between each water molecule to force the water into an open crystal.
- The covalent bonds between each atom molecule dominate the water's entropy.
- The relative kinetic energy of the ammonia molecules is high enough for hydrogen bonds between each water molecule to arrange the water into an open crystal.

20. Which type of electromagnetic radiation has the lowest energy per photon?

- Microwave
- Infrared
- Ultraviolet
- X-rays

21. What is a problem with the Solar System model for the atom?

- There is no problem with this model, the electrons actually follow distinct orbits around the nucleus.
- Quantum mechanics does not permit orbits with arbitrary energy levels.
- The nucleus will fuse with itself and explode.
- Electrons are not planets, they are more like small asteroids.

22. Concerning electrons passing through a double slit, when you...

- measure which slit the electron went through, you destroy the interference pattern.
- watch the screen, the interference pattern oscillates back and forth at 3 Hz.
- do not observe the electron, it behaves like a particle.
- observe the electron it behaves like a wave.

23. The uncertainty principle states:

- Electrons are indistinguishable particles.
- You must collapse a wave function to create a photon.
- No two electrons can occupy the same orbital in an atom.
- You cannot simultaneously know where an electron is and where it is going.

24. What new property do we consider when allowing two electrons to occupy the same orbital?

- oscillations
- spin
- interference
- diffraction

25. What principle states: No more than two electrons can occupy the same orbital (in a given shell)?

- Brownian exclusion principle
- Heisenberg exclusion principle
- Pauli exclusion principle
- Lamb-shift

26. Chemical behavior is determined by the outermost electrons, called

- valet electrons.
- quantum field electrons.
- periodic electrons.
- valence electrons.

27. What is true about the periodic table? (use the one on the room wall)

- Groups 1 and 17 are very unstable while group 18 is very stable.
- Groups 17 and 18 are very stable while group 1 is very reactive.
- Lead is the only halogen that is gaseous at room temperature.
- Groups 1 and 17 behave completely differently.

28. What is Ionization energy?

- The energy required for nuclear fission.
- The energy required to free an electron from an atom.
- The energy needed to ionize a person's opinion.
- The energy required to bring an electron from a low energy state to a high energy state in an atom.

PART 2 SHORT ANSWER - Respond within box, add paper if more space is needed

29. Suppose you're in a bus traveling at 60mph. You throw an orange toward the front of the bus at 20 mph. Then you send a light beam toward the front of the bus at the speed of light. From the perspective of a pedestrian observing the bus from the sidewalk, how fast was the orange traveling? From the perspective of a pedestrian observing the bus from the sidewalk, how fast was the light moving?

30. As a pendulum comes to a rest, what happens to the energy?

31. What is the difference between diffraction and refraction? Give an example of each.

32. If a door between a brightly lit room and a dark one is left slightly ajar, there will be a band of light on the floor. If the door is slowly closed, what happens to this band of light? Why?

33. List the 6 materials on the right in order of increasing density.

- | | |
|----|-----------|
| 1. | Lead |
| 2. | Aluminum |
| 3. | Diamond |
| 4. | Styrofoam |
| 5. | Gold |
| 6. | Helium |

34. Use the molecular model of matter to explain why perfume spilled at one end of a room can be smelled at the other end after a few seconds.

35. Use a qualitative(no numbers needed) time-line to map out the sequence of events(experiments) and models that led to the Bohr model.

36. Explain how the double-slit experiment can show both the particle and wave nature of matter.

37. What is the difference between an orbital and an orbit?

38. The valence electrons of an element have the electronic configuration $6s^26p^6$. Identify the element and make a prediction about its physical state at room temperature and its tendency to react with other elements.

39. A object slides across the table and comes to a rest because of friction. Explain how there is more “order” in the beginning and more “disorder” and the end of this process.

40. Describe how a forensic scientist would use the techniques of spectroscopy to identify an unknown white crystalline powder found in the locker room of a professional athlete.