

UVU PS1000 Final

Do not write on the exam itself. Put your name and record your answers on the Scantron sheet. Turn in the exam and the Scantron sheet when you are finished.

1. A bullet is fired horizontally from a gun at the same time that another bullet is dropped from the same height as the gun. The masses of the two bullets are not the same and air resistance is neglected. Which of the following statements is true?
 - (a) The two bullets have the same acceleration downward.
 - (b) The dropped bullet reaches the ground before the one that was shot from the gun.
 - (c) The bullet fired from the gun reaches the ground before the dropped bullet does.
 - (d) The more massive bullet reaches the ground first.
 - (e) The less massive bullet reaches the ground first.
2. An astronaut measures the mass and length of a ruler before taking it on a flight to Neptune. While traveling at a speed near the speed of light, the astronaut measures the mass and length of the ruler again and finds that
 - (a) its mass is larger, but its length is the same.
 - (b) its length is shorter, but the mass is the same.
 - (c) its mass is the same and its length is the same.
 - (d) its mass is larger, but its length is shorter.
 - (e) its mass is larger and its length is longer.
3. The basic difference between red and violet light viewed in a vacuum is that
 - (a) violet has shorter wavelengths.
 - (b) red has shorter wavelengths.
 - (c) violet has greater speed.
 - (d) red has greater speed.
 - (e) violet photons have less energy.
4. Which of the following chemical equations is properly balanced?
 - (a) $\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
 - (b) $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
 - (c) $\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}_2$
 - (d) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
 - (e) both (b) and (d)
5. The number of valence electrons in phosphorous (P) is
 - (a) 2

- (b) 3
 - (c) 4
 - (d) 5
 - (e) 6
6. The control rods in a nuclear fission reactor can reduce the energy production of the reactor by what
- (a) increasing the number of free neutrons in the core.
 - (b) decreasing the number of free neutrons in the core.
 - (c) increasing the speed of free neutrons in the core.
 - (d) decreasing the speed of free neutrons in the core.
 - (e) decreasing the amount of fuel.
7. Our understanding of the interior structure of the the earth is primarily determined from
- (a) Chemical analysis.
 - (b) drill holes.
 - (c) earthquake waves.
 - (d) radio waves.
 - (e) rock samples.
8. The geological age of the earth is estimated to be 4.55 billion years by using
- (a) the principle of superposition.
 - (b) the thickness of sediments.
 - (c) the salinity of the oceans.
 - (d) the principle of inclusions.
 - (e) radiometric dating.
9. The final state of the Sun will be a
- (a) red giant.
 - (b) white dwarf.
 - (c) neutron star.
 - (d) black dwarf.
 - (e) supernova.
10. Of the following, which is the best evidence for an expanding universe?
- (a) cosmological redshift
 - (b) cosmological blueshift
 - (c) background microwave radiation

- (d) correct hydrogen-helium ratios
 - (e) spontaneous creation of matter
11. Which two of the four fundamental forces do we deal with most in our daily lives?
- (a) gravitational and nuclear
 - (b) electromagnetic and gravitational
 - (c) electromagnetic and quintessence
 - (d) nuclear strong and nuclear weak
 - (e) gravitational and nuclear strong
12. You throw a baseball up into the air. What is the baseball's acceleration at the top of its flight?
- (a) Zero
 - (b) $9.8 \frac{\text{ft}}{\text{s}^2}$
 - (c) $9.8 \frac{\text{m}}{\text{s}^2}$
 - (d) $32 \frac{\text{m}}{\text{s}^2}$
 - (e) $32 \frac{\text{m}}{\text{s}}$
13. What is true about air resistance?
- (a) A falling body will not reach a constant acceleration.
 - (b) Terminal velocity keeps increasing as you fall.
 - (c) A falling body will reach a constant velocity.
 - (d) Air resistance is negligible in any situation on earth.
 - (e) A falling body will reach a non-zero constant acceleration.
14. To decrease the pressure caused by a force, how must you change the area to which it's applied?
- (a) Decrease the area.
 - (b) Apply more force.
 - (c) Increase the pressure.
 - (d) Distribute it into smaller separated areas.
 - (e) Increase the area.
15. When a diver tucks in to a fetal position he will begin to flip around faster. This is an example of conservation of...
- (a) mass
 - (b) charge

- (c) surface area
- (d) angular momentum
- (e) linear momentum

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

- (a) convection
- (b) radiation
- (c) inhomogeneous wave packet flux
- (d) conduction
- (e) black-body spectrum transfer

17. Sound travels at about .2 miles per second. If you hear thunder 5 seconds after seeing lightning, about how many miles away is the lightning?

- (a) 2 miles
- (b) 1 mile
- (c) 5 miles
- (d) 10 miles
- (e) 5.2 miles

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

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

19. Temperature is a measure of...

- (a) the rate of chemical reactions in the sample.
- (b) the number of particles in a system.
- (c) heat flow into the sample.
- (d) the average kinetic energy of the molecules.
- (e) the rate of change entropy with respect to the change in internal energy while keeping the volume and number of particles constant.

20. Why does water expand when it freezes?

- (a) It actually does not expand when it freezes, it only expands at around 4 C^0 .
- (b) The covalent bonds between each atom molecule dominate the water's entropy.
- (c) The relative kinetic energy of the air molecules is high enough for hydrogen bonds between each soup molecule to arrange the water into an open crystal.
- (d) The kinetic energy of the water molecules is low enough for hydrogen bonds between each water molecule to force the water into an open crystal.
- (e) 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.

21. The Heisenberg uncertainty principle states:

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

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

- (a) Brownian exclusion principle
- (b) Heisenberg uncertainty principle
- (c) Bohr's degeneracy principle
- (d) Planck double constraint principle
- (e) Pauli exclusion principle

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

- (a) wave packet valets
- (b) grouped electron standing waves
- (c) valence electrons
- (d) ion surface electrons
- (e) Maxwell electrons

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

- (a) Alkali metals are very reactive, the noble gases and halogens are not.
- (b) Groups 17 and 18 are very stable while group 1 is very reactive.
- (c) Groups 1 and 17 behave completely differently.
- (d) Alkali metals and halogens are very reactive, the noble gases are not.
- (e) Periods 1 and 2 are most stable.

25. What is Ionization energy?

- (a) The energy required for nuclear fission.
 - (b) The energy required to free an electron from an atom.
 - (c) The energy needed to ionize a person's opinion.
 - (d) The energy required to bring an electron from a low energy state to a high energy state in an atom.
 - (e) The energy difference between isotopes of the same element.
26. What is the difference between diffraction and refraction?
- (a) diffraction is bending of light waves when they enter a different material while refraction is the spreading of light at obstructions.
 - (b) diffraction is when light waves are absorbed by atoms, refraction is when the excited atoms emit the energy from the absorbed light waves..
 - (c) diffraction is bending of light waves by magnetic fields, refraction is when light bounces off a shiny surface.
 - (d) refraction is bending of light waves when they enter a different material while diffraction is the spreading of light at obstructions.
 - (e) diffraction is when you separate light waves into their component colors, refraction is the spreading of light through slits.
27. Which of the following is the correct order for the materials in increasing density
- (a) Balsa wood, Aluminum, Copper, Lead, Gold
 - (b) Aluminum, Lead, Copper, Balsa wood, Gold
 - (c) Gold, Lead, Copper, Aluminum, Balsa wood
 - (d) Aluminum, Balsa wood, Copper, Gold, Lead
 - (e) Balsa wood, Aluminum, Copper, Gold, Lead
28. The double-slit experiment shows both the particle and the wave nature of matter by
- (a) refractive index differences resulting in anomalous dispersion of wave packets
 - (b) dispersion of light making interference patterns on a screen, but when you measure the intensity the pattern changes
 - (c) nodes and anti-nodes from compressions waves changing when measured.
 - (d) diffraction of electrons making interference patterns on a screen only when not observed at the slits.
 - (e) not allowing simultaneous measurements of arbitrary precision of both the positions and momenta of alpha particles.
29. What were the sequence of events(experiments) and models that led to the Bohr model?
- (a) Rutherford scattering, Millikan oil drop, de Broglie matter waves
 - (b) Plum pudding model, Rutherford scattering, Schrodinger wave equation
 - (c) Benjamin Franklin fluid model, Millikan oil drop, Plum pudding model

- (d) Rutherford scattering, Millikan oil drop, de Broglie matter waves
 - (e) Plum pudding model, Rutherford scattering, Solar system model
30. What is the difference between an orbital and an orbit?
- (a) An orbital is a superposition of orbits.
 - (b) An orbit is a path of motion for a point particle, an orbital is a 3 dimensional standing wave for the probability of a particle's position.
 - (c) An orbit is a circle, an orbital is a sphere.
 - (d) Orbitals are composed of multiple closed orbits.
 - (e) An orbit is a path of motion for a probability wave, an orbital is a mapping of the wave into real space.
31. The valence electrons of an element have the electronic configuration $1s^2 2s^2 2p^5$. Identify the element and make a prediction about its tendency to react with other elements.
- (a) Neon, it is very stable and does not react with other elements at all.
 - (b) Flourine, very reactive with other elements.
 - (c) Chlorine, it is a halogen so it reacts with other elements.
 - (d) Flourine, it is very stable and does not react with other elements at all.
 - (e) Neon, it is an inert gas so it reacts with other elements.
32. The major difference between saturated and unsaturated fats is
- (a) Saturated fats are linear and more solid at room temperature. Unsaturated fats have kinks in their hydrocarbon tails which increases their melting point.
 - (b) Saturated fats are linear and tend to liquify easily. Unsaturated fats have kinks in their hydrocarbon tails which increases their melting point.
 - (c) Saturated fats are linear and more solid at room temperature. Unsaturated fats have kinks in their hydrocarbon tails which lowers their melting point.
 - (d) Saturated fats have twisted hydrocarbon tails, unsaturated fats do not.
 - (e) Saturated fats are found in animals, unsaturated fats are not found in animals.
33. Which are the correct three radioactive particles and which one can penetrate matter the most?
- (a) alpha, beta, gamma, alpha particles penetrate matter the most
 - (b) alpha, beta, gamma, gamma rays penetrate matter the most
 - (c) protons, neutrons, electrons, neutrons can penetrate matter the most because it's neutral
 - (d) alpha, beta, gamma, beta particles are high energy electrons that penetrate the most.
 - (e) alpha, theta, gamma, alpha particles penetrate matter the most
34. What is most dangerous about a radioactive isotope?
- (a) Even a single radioactive atom emits radiation in all directions making it hard to contain safely.

- (b) They might have more neutrons than a stable isotope of the same atom making them sensitive to nucleon absorption.
 - (c) When they are highly concentrated any human tissue nearby will receive high doses of radiation.
 - (d) When they are highly concentrated they have the potential to cause nuclear bombs.
 - (e) It's only when they are highly spread out because then they poison more life forms.
35. A sample starts with 100% of a certain isotope at noon. At 8pm on the same day, the sample is down to 25%. What is the half-life of this sample?
- (a) one-eighth of an hour
 - (b) 2 hours
 - (c) 4 hours
 - (d) 8 hours
 - (e) one-quarter of an hour
36. What are some major evidences for plate tectonics and Pangaea?
- (a) consistent ice formation, aligned electric fields in fossils, and earthquake patterns
 - (b) consistent glacier tracks, aligned magnetic fields in the ferrous rocks, and paleoclimatic consistencies
 - (c) volcano patterns, the steepness of the Rocky Mountains, and fossils that have similar carbon datings.
 - (d) consistent soil composition, alignment of gravitational fields in porous rocks, and the density of volcanic activity in Iceland
 - (e) consistent rock forms across plates, aligned electric fields in iron and nickel rich rocks, and a correlated precession of the earths orbit
37. What is false about global warming?
- (a) The Earth's atmospheric CO₂ concentrations are increasing.
 - (b) Water molecules in the clouds slows the greenhouse effect by reflecting solar radiation because it is white.
 - (c) Human caused atmospheric composition changes are impossible.
 - (d) The glaciers are receding.
 - (e) Temperature changes from natural processes will continue.
38. What greenhouse gas is most abundant?
- (a) H₂O - water vapor
 - (b) CO₂ - carbon dioxide
 - (c) CH₄ - methane
 - (d) N₂O - nitrous oxide
 - (e) SF₆ - sulfur hexa-flouride
39. Where is the empirical evidence for anthropogenic contributions to climate change?

- (a) Vostok ice core measurements of CO₂ concentration in the past
 - (b) The sharp increase in Mauna Lao's measurements of CO₂ concentration
 - (c) The increase of chlorofluorocarbons in the atmosphere is directly correlated with the Hockey Stick graph temperature rise
 - (d) Smog increasing above metropolis areas
 - (e) The recent increase of special interest groups
40. Which is true about our solar system?
- (a) Sagittarius A* is in the center
 - (b) It has 8 planets orbiting around a star we call the Sun
 - (c) The Jovian planets are hotter and more dense than the terrestrial planets.
 - (d) It is over a light year in diameter
 - (e) It is large enough to be considered a dwarf galaxy
41. What makes Earth so much different than the other planets?
- (a) It's flat
 - (b) It has a bi-modal surface from the abundance of water as it formed
 - (c) It has much more iron and silicon
 - (d) Its orbit is orthogonal to the ecliptic
 - (e) The surface is extremely smooth resulting in a perfect spheroidal shape
42. What exactly makes Pluto not a planet?
- (a) It does not clear its own path
 - (b) It is too small
 - (c) It is not in hydrostatic equilibrium
 - (d) Its orbit is not in the same plane as all the other planets
 - (e) It is too far away
43. What element is in abundance within the Sun that will allow it to live another 5 billion years?
- (a) Iron
 - (b) Carbon
 - (c) Helium
 - (d) Hydrogen
 - (e) Neon
44. What is the name of the diagram with the color/temperature relation in the main sequence of stars?
- (a) Hubble diagram

- (b) Hertzsprung-Russel diagram
 - (c) Ven diagram
 - (d) Friemann-Lamaitre-Robertson-Walker diagram
 - (e) Hertzsprung-Rippel diagram
45. A red star and a blue star have the same apparent brightness. What can you conclude about their distances away you?
- (a) The red star is closer than the blue star.
 - (b) You cannot conclude anything about their distance, only their temperature.
 - (c) The blue star is closer than the red star.
 - (d) They are the same distance away.
 - (e) You cannot conclude anything about the blue “star”, the red glow you thought was a star is not, it is a galaxy at least 100 million light years away.
46. Sagittarius A* is a
- (a) famous type IIa supernova that occurred in the Andromeda galaxy that Edwin Hubble discovered.
 - (b) super-massive black hole in the center of the Milky-Way galaxy.
 - (c) quasar galaxy directly behind the red giant star Betelgeuse.
 - (d) spiral galaxy arm that our solar system is located.
 - (e) Cepheid star that was considered the first “standard candle” in astronomy.
47. What happens to a star with a mass above 1.4 solar masses?
- (a) It eventually spreads out into a binary Cepheid nebula.
 - (b) It eventually creates at least a Type Ia supernova.
 - (c) It eventually helium flashes into a planetary nebula.
 - (d) It produces periodic gamma-ray bursts
 - (e) It becomes a brown dwarf failed star.
48. The expansion of the universe is moving galaxies away from each other, but what is happening within the galaxies?
- (a) The stars within each galaxy are expanding away from each other too.
 - (b) The galaxies expand but not nearly as fast as their observable universe is expanding.
 - (c) Within the galaxies there is no expansion at all.
 - (d) The inner parts of the galaxies are blue shifting relative to the perimeter stars.
 - (e) The galactic centers are becoming quasars.
49. According to the Hubble ultra deep field, about how old is the universe?

- (a) 4.55 billion years
- (b) 13.57 million years
- (c) 4.58 million years
- (d) 13.75 billion years
- (e) 10.22 million years

50. Only 4% of the universe is matter that is familiar to us, i.e. atoms. What is the rest made of?

- (a) Dark energy and 4th generation transparent baryonic quintessence
- (b) 73 % Dark Matter and 23% Dark Energy
- (c) An unknown ratio of Dark Matter and Dark Energy
- (d) WIMPS and 4th generation MACHOS in the baryogenesis phase
- (e) 23% Dark Matter and 73% Dark Energy