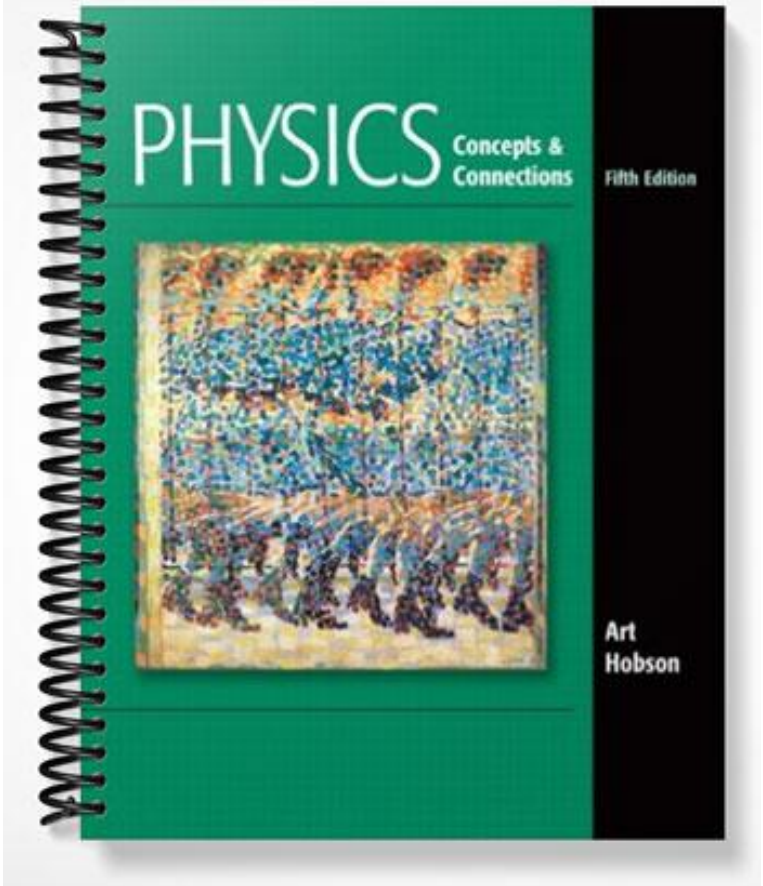
TEST BANK



MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The "father" of atomic materialism was 1) _____
A) Democritus.
B) Newton.
C) Plato.
D) Ptolemy.
E) Kepler.
Answer: A

2) The Greek model of the atom should be classified as 2) _____
A) an experimental fact.
B) a useless falsehood.
C) an observation.
D) a useful theory.
E) a tentative hypothesis.
Answer: D

3) The idea that everything is made of small particles is 3) _____
A) a useful theory, but not known for certain.
B) still only a tentative speculation made by many scientists.
C) not yet widely accepted.
D) a useful idea that is known for certain to be true.
E) false and no longer used by scientists.
Answer: A

4) Evidence that things are made of atoms comes from 4) _____
A) the fact that we can cut solid objects into smaller and smaller pieces.
B) Brownian motion.
C) the way that laser beams pass through air.
D) the fact that objects accelerate as they fall.
E) superconductivity.
Answer: B

5) Evidence that things are made of atoms comes from 5) _____
A) from the observation that, when chemicals combine to form new chemicals, they do so in simple ratios by weight.
B) the observation that we can smell things such as bread from a distance.
C) Both of the above answers.
D) Brownian motion.
E) All of the above answers.
Answer: E

6) Today, the idea that everything is made of atoms should be classified as 6) _____
A) a certainty.
B) a fact.
C) Both of the above.
D) a theory.
E) a hypothesis.
Answer: D

7) Why can't you directly observe, with the unaided eye, Brownian motion in easily visible objects su ch as

floating bits of paper? 7) __ __ __ _

A) Because atoms are so small that you can't see them with the unaided eye.
B) Because only living organisms such as bacteria exhibit Brownian motion.
C) Because bits of paper are so massive [or heavy] that they do not respond noticeably to atomic impacts.
D) Because paper cannot be electrically charged, so it cannot respond to Brownian forces by individual atoms.
E) Because only individual atoms and molecules exhibit Brownian motion.
Answer: C

8) One piece of evidence that Democritus found for his idea that everything is made of atoms was 8) _____
A) the smell of bread and of other substances.
B) the random, chaotic motions often found in liquids.
C) the fact that chemicals combine in definite proportions.
D) Brownian motion.
E) the twinkling of stars, due to our atmosphere.
Answer: A

9) An individual sulfur atom has twice the weight of an individual oxygen atom. What is the weight ratio of sulfur and oxygen in the formation of sulfur dioxide? 9) _____
A) 1 part sulfur to 2 parts oxygen
B) 2 parts sulfur to 1 part oxygen
C) 1 part sulfur to 1 part oxygen
D) 4 parts sulfur to 1 part oxygen
E) 1 part sulfur to 4 parts oxygen
Answer: C

10) An individual oxygen atom has 16 times the weight of an individual hydrogen atom. What is the weight ratio of oxygen to hydrogen in water? 10) _____
A) 1 part oxygen to 2 parts hydrogen
B) 16 parts oxygen to 1 part hydrogen
C) 1 part oxygen to 8 parts hydrogen
D) 8 parts oxygen to 1 part hydrogen
E) 1 part oxygen to 16 parts hydrogen
Answer: D

11) Roughly how many different elements are there? 11) _____
A) many more than 1000
B) 20
C) 4
D) 100
E) 1000
Answer: D

12) Roughly how many different chemical compounds are there? 12) _____
A) 20
B) 4
C) 100
D) many more than 500

E) 500
Answer: D

13) The number of atoms in the glucose molecule, $C_6H_{12}O_6$, is 13) _____
A) 4.
B) 3.
C) 24.
D) 48.
E) cannot be determined from the given information.
Answer: C

14) How many atoms are in the alcohol molecule C_2H_5OH? 14) _____
A) 9
B) 3
C) 4
D) 11
E) insufficient information is given
Answer: A

15) The number of atoms in the sulfuric acid molecule, H_2SO_4, is 15) _____
A) 6.
B) 4.
C) 7.
D) 3.
E) cannot be determined from the given information
Answer: C

16) Suppose that a particular chemical substance A is "pure" [contains no "impurities"], and that it can be chemically decomposed into two other pure materials B and C. What conclusion can be draw from this? 16) _____
A) A must be an element.
B) B and C must be chemical compounds.
C) A must be a chemical compound.
D) B and C must be elements.
E) Nonsense--it is impossible to decompose a pure substance into two other materials.
Answer: C

17) Suppose that a particular chemical substance is "pure" [contains no "impurities"], and that it is not possible to decompose this substance by chemical means. What can we conclude from this? 17) _____
A) The substance must be incapable of entering into chemical reactions of any kind.
B) The substance must be an element.
C) The substance must be one of the ideal, or perfect, gases.
D) The substance must be a chemical compound.
E) None of the above.
Answer: B

18) Chemically, helium is 18) _____
A) a solid.
B) an isotope.
C) a mixture.
D) a compound.
E) an element.

Answer: E

19) An odor, such as the odor of bread, is due to 19) _____
A) individual atoms that detach from the source and diffuse individually through the air.
B) molecules that detach from the source and diffuse through the air.
C) cosmic vibrations emanating from the Great Pumpkin.
D) a pressure wave, similar to a sound wave, emitted by the violets.
E) an electromagnetic wave emitted by the source [the bread].
Answer: B

20) At the microscopic level, the difference between liquids and solids is that 20) _____
A) the liquid's atoms move throughout the liquid, while the solid's atoms remain near their original locations.
B) in a liquid, the individual atoms are larger.
C) there is much more distance [at least 10 times more] between neighboring atoms in a liquid than between neighboring atoms in a solid.
D) both answers A and B are correct.
E) both answers B and C are correct.
Answer: A

21) At the microscopic level, the difference between gases and solids is that 21) _____
A) there is much more distance (at least 10 times more) between neighboring atoms in a gas than between neighboring atoms in a solid.
B) the gas's atoms move throughout the gas, while the solid's atoms remain near their original locations.
C) in a gas, the individual atoms are larger.
D) both answers A and B are correct.
E) both answers B and C are correct.
Answer: D

22) At the microscopic level, the difference between gases and liquids is that 22) _____
A) the gas's atoms move throughout the gas, while the liquid's atoms remain near their original locations.
B) in a gas, the individual atoms are larger.
C) there is much more distance [at least 10 times more] between neighboring atoms in a gas than between neighboring atoms in a liquid.
D) both answers A and B are correct.
E) both answers B and C are correct.
Answer: C

23) Why is it so difficult to remove the lid from a vacuum-sealed jar? 23) _____
A) The vacuum inside the jar pushes outward on the lid, holding it firmly to the jar.
B) The air pressure inside the jar pushes upward on the lid more strongly than the air pressure outside pushes downward on the lid.
C) The air pressure outside the jar pushes downward on the lid more strongly than the air pressure inside pushes upward on the lid.
D) The vacuum inside the jar pulls inward on the lid, holding it firmly to the jar.
E) The higher pressure inside the jar pulls inward on the lid, holding it firmly to the jar.
Answer: C

24) The distance to the sun is about 150 million km. Expressed in powers of ten, this is 24) _____
A) 1.5×10^8 km.

B) 1.5×10^{-6} km.
C) 1.5×10^{-8} km.
D) 1.5×10^{6} km.
E) None of the above.
Answer: A

25) The length of your arm is closest to 25) _____
A) one kilometer.
B) one meter.
C) 100 meters.
D) 10 centimeters.
E) two meters.
Answer: B

26) One kilometer is closest to 26) _____
A) 500 feet.
B) 100 meters.
C) 2 miles.
D) 0.001 meters.
E) 0.5 miles.
Answer: E

27) The U.S. national debt is about $6 trillion. Expressed in powers of ten, this is 27) _____
A) $\$6 \times 10^{15}$. B) $\$6 \times 10^{10}$. C) $\$6 \times 10^{12}$. D) $\$6 \times 10^{6}$. E) $\$6 \times 10^{9}$.
Answer: C

28) In words, 3.5×10^{11} is 28) _____
(HINT: Write this number out before trying to answer the question.)
A) 350 billion.
B) 35 million.
C) 3.5 trillion.
D) 35 billion.
E) 350 million.
Answer: A

29) It is 39 trillion miles to the nearest star beyond the sun. Expressed in powers of ten, this is 29) _____
A) 3.9×10^{10}. B) 3.9×10^{12}. C) 3.9×10^{13}. D) 3.9×10^{9}.
Answer: C

30) A "megawatt" is 30) _____
A) 1,000,000,000 watts.
B) 1,000,000 watts.
C) 100 watts.
D) 1000 watts.
E) None of the above.
Answer: B

31) The universe is only seconds old, a million trillion seconds in fact. In powers of 10, this number is 31) _____
A) 10^{21}.
B) 10^{17}.

C) 10^{19}.
D) 10^{15}.
E) None of the above.
Answer: E

32) The diameter of an atomic nucleus is about a hundredth of a trillionth of a meter. In powers of 10, this is 32) _____
A) 10^{-17} m. B) 10^{-14} m. C) 10^{-10} m. D) 10^{-11} m. E) 10^{-15} m.
Answer: B

33) Which is lightest in weight? 33) _____
A) electron
B) hydrogen atom
C) proton
D) water molecule
E) oxygen atom
Answer: A

34) Which is heaviest? 34) _____
A) hydrogen atom
B) water molecule
C) oxygen atom
D) proton
E) electron
Answer: B

35) Which is smallest? 35) _____
A) the Milky Way galaxy
B) the ripples in the cosmic background radiation
C) the sun
D) the solar system
E) the distance to other nearby stars
Answer: C

36) Comparing the size of a wavelength of light with the size of an atom, 36) _____
A) they are about the same size.
B) atoms are much larger.
C) atoms are much smaller.
D) some lightwaves are larger than atoms, but others are smaller than atoms.
E) some atoms are are larger than a lightwave, but others are small than a lightwave.
Answer: C

37) Is there any method by which we can detect individual atoms in the laboratory? 37) _____
A) No, because atoms are purely mathematical abstractions and not real physical objects.
B) Yes, by using very high power microscopes based on visible light of very short wavelength.
C) No, because atoms are smaller than any physical wavelengths.
D) Yes, by using microscopes based on X-rays rather than on light.
E) Yes, by using microscopes based on the "matter waves" made by material particles such as electrons.
Answer: E

38) According to the philosophy of Democritus, 38) _____

A) the color red is not "real" but is instead just humans' "conjecture" or imagination.
B) atoms are not "real" but are instead just humans' "conjecture" or imagination.
C) Both of the above.
D) Neither of the above.
E) the moon is really a giant frog.
Answer: A

39) According to the philosophy of Democritus, 39) _____
A) smells and other "sense impressions" are "real"--that is, they really exist.
B) atoms are real.
C) both A and B are true.
D) the things you imagine, in your mind, are real.
E) nothing really exists.
Answer: B

40) Suppose that Democritus were alive today, and that he saw a bright red fire truck. He would say that 40) _____
A) the color of the fire truck is less real than the atoms of which it is made.
B) the color of the fire truck is more real than the atoms of which the truck is made.
C) the color of the fire truck, and the atoms of which it is made, are equally real.
D) neither the color, nor the truck, nor the atoms are real.
Answer: A

41) Democritus said that, although we imagine many things, "in reality, there are only atoms and the void." This idea could best be classified as 41) _____
A) idealism.
B) stoicism.
C) materialism.
D) rationalism.
E) witticism.
Answer: C

42) According to the atomic materialist philosophy, certain things are regarded as "real" and other things as merely "imaginary." Which of the following is [or are] regarded by this philosophy as real? 42) _____
A) atoms
B) directly observable phenomena such as color and warmth
C) human emotions
D) Both answers A and B are correct.
E) None of the above are regarded as real by the atomic materialist philosophy.
Answer: A

43) A block of granite is actually mostly empty space because the atoms making up the granite are 43) _____
A) made of cotton candy.
B) in perpetual motion.
C) themselves mostly empty space.
D) not as close together as they could be.
E) held together by electrical forces.
Answer: C

44) Which scientific theory or theories of the atom agrees with all of the atomic experiments performed to date? 44) _____

A) The Greek theory of the atom.
B) The planetary theory of the atom.
C) The quantum theory of the atom.
D) Both the planetary theory and the quantum theory of the atom.
E) None of the above theories agree with all of the atomic experiments performed to date.
Answer: C

45) According to the planetary model, an atom is 45) _____
A) impossible to visualize [or picture].
B) a single tiny object, not made of parts.
C) made of protons, electrons, and ions.
D) made of protons, electrons, and neutrons.
E) made of protons and electrons.
Answer: D

46) A feature of the quantum model of the atom that is <u>not</u> a feature of the Greek or planetary models is that 46) _____
A) the quantum model is only a theory, whereas the other two models are supported by factual evidence.
B) the quantum model of the atom cannot be visualized.
C) Both of the above.
D) the quantum model can explain electrical effects.
E) All of the above.
Answer: B

47) Historically, the earliest atomic model to explain electrical phenomena was 47) _____
A) the Greek model.
B) the Hollywood model.
C) the quantum model.
D) Galileo's model.
E) the planetary model.
Answer: E

48) What is the similarity between burning and respiration? 48) _____
A) Both reactions consume energy.
B) Both reactions involve the combination of carbon with oxygen.
C) Both reactions create oxygen.
D) Both reactions consume glucose.
E) Actually there is no similarity between them.
Answer: B

49) In the photosynthesis reaction 49) _____
A) oxygen combines with the ATP molecule.
B) oxygen combines with the carbon in glucose.
C) CO_2 combines with glucose.
D) carbon combines with the ATP molecule.
E) CO_2 combines with H_2O.
Answer: E

50) The reverse of the photosynthesis reaction is 50) _____
A) the respiration reaction.
B) the photolysis reaction.

C) the reduction reaction.
D) the combustion reaction.
E) nonsense--the photosynthesis reaction is not reversible.
Answer: A

51) Where does the chemical reaction known as "respiration" occur? 51) _____
A) at many points all over your body
B) in your nose
C) in the lining of your lungs
D) in living plants
E) in the air while it is being held in your lungs
Answer: A

52) In the respiration reaction 52) _____
A) CO_2 combines with H_2O.
B) carbon combines with such biological molecules as DNA.
C) oxygen combines with the carbon in such biological molecules as glucose.
D) CO_2 combines with the carbon in such biological molecules as glucose.
E) oxygen combines with such biological molecules as DNA.
Answer: C

53) The reverse of the respiration reaction is the reaction known as 53) _____
A) combustion.
B) inhaling.
C) photo-synthesis.
D) exhaling.
E) oxidation.
Answer: C

54) The chemical formula that represents the burning of wood or paper is 54) _____
A) $H_2 + O \Rightarrow H_2O$.
B) $C + O \Rightarrow CO$.
C) $C + O_2 \Rightarrow CO_2$.
D) $CO_2 \Rightarrow C+O_2$.
E) $C + H_2O \Rightarrow CH_2O$.
Answer: C

55) Air is composed mainly of 55) _____
A) CO_2 and O_2.
B) O_2.
C) N_2 and O_3.
D) CO_2 and O_3.
E) N_2 and O_2.
Answer: E

56) Which one of the following reactions is the most similar chemically to combustion? 56) _____
A) fission in nuclear reactors
B) vaporization in the atmosphere
C) photosynthesis in plants
D) respiration in animals
E) fusion in stars

Answer: D

57) Chemically, clean [nonpolluted] air is 57) _____
A) a compound.
B) a mixture of different compounds.
C) a liquid.
D) an isotope.
E) an element.
Answer: B

58) The number of atoms in the sulfuric acid molecule, H_2SO_4, is 58) _____
A) 7. B) 3. C) 4. D) 6.
Answer: A

59) Chemically, clean [non-polluted] air is 59) _____
A) an isotope. B) an element. C) a compound. D) a mixture.
Answer: D

1) A
2) D
3) A
4) B
5) E
6) D
7) C
8) A
9) C
10) D
11) D
12) D
13) C
14) A
15) C
16) C
17) B
18) E
19) B
20) A
21) D
22) C
23) C
24) A
25) B
26) E
27) C
28) A
29) C
30) B
31) E
32) B
33) A
34) B
35) C
36) C
37) E
38) A
39) B
40) A
41) C
42) A
43) C
44) C
45) D
46) B
47) E
48) B
49) E
50) A
51) A

52) C
53) C
54) C
55) E
56) D
57) B
58) A
59) D