

DIAGNOSTIC TEST IN PHYSICAL SCIENCE
SY 2022-2023

Instructions: Read each question and/or statement carefully and shade the correct answer in the answer sheet provided for you. Do not write anything on this test questionnaire.

NOTE: Print the Diagnostic Test in color.

1. What refers to the formation of the heavy elements by fusion of lighter nuclei within stars?
 - A. nuclear fusion
 - B. nuclear fission
 - C. stellar nucleosynthesis
 - D. supernova nucleosynthesis

2. What is the difference between transuranic elements and super heavy elements?
 - A. The former are elements with atomic numbers beyond lawrencium ($Z = 103$) while the latter are synthetic elements with atomic numbers higher than that of uranium ($Z = 92$).
 - B. The former are elements with atomic numbers beyond lawrencium ($Z = 92$) while the latter are synthetic elements with atomic numbers higher than that of uranium ($Z = 103$).
 - C. The former are synthetic elements with atomic numbers higher than that of uranium ($Z = 103$) while the latter are elements with atomic numbers beyond lawrencium ($Z = 92$).
 - D. The former are synthetic elements with atomic numbers higher than that of uranium ($Z = 92$) while the latter are elements with atomic numbers beyond lawrencium ($Z = 103$).

3. Which statements demonstrate accurate data when the intermolecular forces of a molecule are stronger?
 - I. Viscosity is higher.
 - II. Solubility is greater. I
 - II. Vapor pressure is higher.
 - IV. Surface tension is weaker.
 - A. I and II
 - B. I and III
 - C. II and III
 - D. II and IV

For the no.4 item, one or more of the options may be correct. Select your answer, A-D, using the following code.

Table 1. Coding of the Correct Answer(s)

Code			
A	B	C	D
I, II and III are only correct.	I and III are only correct.	II and IV are only correct.	IV is only correct.

4. Which of the following examine(s) the shape or molecular geometry of a substance using VSEPR?

- I. Finding the central atom of a molecule
- II. Drawing the appropriate free-body diagram of the molecule
- III. Determining the electron pair orientation using the total number of atoms
- IV. Naming the shape or molecular geometry based on the location of the atoms

5. Based on their relative strengths of attraction, evaluate the comparison between intermolecular forces.

- A. dipole-dipole < ion-dipole
- B. ion-dipole = dipole-dipole
- C. hydrogen bonding < London dispersion forces
- D. London dispersion forces = hydrogen bonding

6. What is known as the ability of a substance (solid, liquid, or gas) to dissolve in a given substance (solid, liquid, or gas)?

- A. solubility
- B. viscosity
- C. boiling point
- D. melting point

7. Which drink sources contains lactose?

- A. beer
- B. juice
- C. milk
- D. wine

8. Pescatarian (sometimes spelled "pescetarian" with an e) is a term sometimes used to describe those who abstain from eating all meat and animal flesh with the exception of fish and other seafood. What macromolecule does seafood most likely fall under?

- A. lipid
- B. protein
- C. nucleic acid
- D. carbohydrate

9. It states that reacting substances must come into contact with enough activation energy and correct orientation.

- A. Big bang
- B. Collision
- C. Kinetic
- D. Relativity

10. Which statement BEST describes how a catalyst can speed up a chemical reaction?

- A. It makes lower energy pathways available.
- B. It increases the concentration of products.
- C. It increases the concentration of reactants.
- D. It binds to the enzymes to release substrates.

11. What will happen once the reaction is used up?

- A. It stops.
- B. It blows.
- C. It continues.
- D. It disappears.

12. Using the balanced equation: $4\text{H}_2 + 2\text{O}_2 \rightarrow 4\text{H}_2\text{O}$

A student reacts 50 g of H_2 with an excess of oxygen and produces 350 g of H_2O . Find the percent yield for this reaction.

- A. 77.78 %
- B. 78.77%
- C. 87.77%
- D. 97.78%

13. An island has a large number of wind turbines and a coal-fired power station. The island needs to use the electricity generated by the coal-fired power station at certain times. Why is this so?

- A. Wind is a renewable energy resource.
- B. Wind turbine power output is constant.
- C. The fuel cost for wind turbines is very high.
- D. The power output of wind turbines is unpredictable.

14. It is commonly known as bleach.

- A. Sodium silicate
- B. Sodium carbonate
- C. Sodium bicarbonate
- D. Sodium hypochlorite

15. What is the function of enzymes in breaking down the food that we eat?

- A. Enzymes serves as a catalyst.
- B. Enzymes increased activation energy.
- C. Enzymes make the reactant bounced off each other.
- D. Enzymes help in lowering the speed of chemical reaction.

16. According to Eratosthenes, which of the following explains why a vertical stick casts a shadow in Alexandria but not in Syene?

- I. The Sun is directly overhead in Syene while in Alexandria, it is only almost directly overhead.
- II. The light rays coming from the sun are parallel, and the Earth is curved.
- III. The light rays coming from the sun are curved, and the Earth is flat.
- IV. The Sun is directly overhead in Alexandria while in Syene, it is only almost directly overhead.

- A. I only
- B. I and II
- C. III and IV
- D. II and IV

17. Why don't we have a lunar eclipse every month?

- I. Lunar eclipses can only occur in autumn.
- II. Astronomers have yet to provide an answer to this question.
- III. We do have them every month, but they are not visible everywhere.
- IV. The Moon's orbit is inclined relative to Earth's orbit and when the moon is full, it is generally either north or south of Earth's shadow

- A. I only
- B. IV only
- C. I and II only
- D. I, II and IV only

18. What do you think is the common between the structures of Stonehenge, the Templo Mayor, the Sun Dagger, and the Big Horn Medicine Wheel?

- A. They all can be used as lunar calendars.
- B. They were all places used for religious sacrifice.
- C. They were all built on the orders of ancient kings.
- D. They were all used by ancient people for astronomical observations.

19. Which of the following is an example of a violent motion?

- A. a water falling
- B. an air moving upward.
- C. a laptop pushed along the table
- D. a vase dropped from the window

20. What is Galileo's concept of falling objects in his experimentation?

- A. object falling with changing speed
- B. object falling with changing direction
- C. object falling with uniform acceleration
- D. object falling with changing acceleration

21. What is the essence of seatbelt in car?
- I. For the safety of the passenger.
 - II. Seatbelts allows the passenger to stay in place, when the car suddenly stops.
 - III. Seatbelts are important safety devices in a car.
- A. I and II only
 - B. I only
 - C. II only
 - D. I, II and III
22. A light bulb produces various wavelengths of energy called light spectrum. The visible light is the segment of electromagnetic spectrum that is visible to human eye. Which of the following colors of the visible light spectrum contains the lowest amount of energy?
- A. blue
 - B. green
 - C. red
 - D. yellow
23. Atomic spectra are created due to the changes in the energy. What subatomic particle is involved in this phenomenon?
- A. electrons
 - B. neutrons
 - C. positrons
 - D. protons
24. On the atomic level energy and matter exhibit the characteristics of ____.
- A. waves only
 - B. particles only
 - C. Both particles and waves
 - D. Neither particles nor waves
25. If your slits from the double slit experiment are further apart, the light waves will:
- A have longer bright fringes
 - B. not produce a diffraction pattern
 - C. be coming from spots that are further apart
 - D. remain as is compared when the slits are narrow
26. Which of the following IS TRUE about rainbows?
- I. Primary and secondary rainbows occur in the order ROYGBIV.
 - II. Rainbow forms a circular arc around the solar point which located above your head.
 - III. Primary rainbow forms between 45° and 50° from anti-solar point.
 - IV. Rainbows result from reflection of sunlight in falling water droplets plus refraction of the light from the back of the droplet.
- A. I
 - B. II

- C. III and IV
- D. II, III, IV

27. Which of the following apparatus did Hertz use to produce the radio waves?

- A. Wire loop
- B. Magnetic inductor
- C. Spark gap transmitter
- D. Semiconductor analyzers

28. Which of the following is a postulate of special relativity?

- A. The color of light is the same for all observers.
- B. Speed of two objects is the same for all observers.
- C. Physicists can make no measurement in a moving reference frame.
- D. The laws of physics are the same for all observers in uniformly moving frames of reference.

29. Jack and Jill are twins, and both have the same height. Jack was sent on space mission to circumnavigate the Solar system for 10 years, flying at constant speed.

After the mission, what difference can be observed between the twins.

- A. Jill will be taller.
- B. Jack will be taller.
- C. Jill will look younger.
- D. Jack will look younger.

30. Teacher Prince discussed on what's so "special" about Special Relativity Theory. He explained the Inertial Reference frame and he presented a video. He then asked the class which of the following reference frames is NOT an inertial reference frame?

- A. A woman on the street not moving.
- B. A woman in a car that is not accelerating.
- C. A man on a car speeding up on a freeway.
- D. A man on a train that is moving at constant velocity.

31. Which of the following is TRUE about black hole?

- A. The black hole will suck up its neighboring objects.
- B. The wavelength will get shorter so as the frequency.
- C. The time slows down when compared to the time on Earth.
- D. The gravitational force is too weak for the light to pass through.

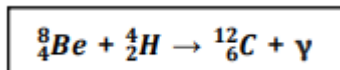
32. What is the branch of science that deals with the celestial objects, space and the physical universe as a whole?

- A. Astronomy
- B. Biology
- C. Chemistry
- D. Physics

33. How the Big Bang Theory supports the idea of the creation of the universe?

- A. Galaxies are moving through space, not with space.
- B. The Big Bang was an explosion that carried matter outward from a point.
- C. The evidence of cosmic microwave background, or energy that was left as a result of recombination.
- D. The universe became hot as it expanded that causes protons and neutrons came together by nuclear fusion.

34. Working in his topic on nuclear reaction, Ben is determined to assess the following equation:



What can he evaluate from the given equation?

- A. The fission of Be-4 and H-4 yield to C-12.
- B. The fission of Be-8 and H-4 yield to C-12.
- C. The fusion of Be-4 and H-4 yield to C-12.
- D. The fusion of Be-8 and H-4 yield to C-12.

For item 35 code the correct assertion-reason statements. Use the code shown in the table.

Table 2. Assertion-Reason Statements

A	Both statements are correct and the second statement is the correct explanation of the first.
B	Both statements are correct but the second statement is not the correct explanation of the first.
C	Statement 1 is true but statement 2 is false.
D	Statement 1 is false but statement 2 is true.

35. Statement 1: Fats and sugars are triglycerides.

Statement 2: Triglycerides are composed of glycerol and three fatty acids.

36. Justify how the distance between the source and the observer affects the increase or decrease in the frequency of sound, light, or waves.

- A. The wavelength of the light is stretched, so the light is seen as 'shifted' towards the red part of the spectrum.
- B. Parallax is an apparent displacement or difference in the apparent position of an object viewed along two different lines of sight.
- C. The cosmic distance ladder is the chain of overlapping methods by which astronomers establish a distance scale for objects in the universe,
- D. Doppler effect is the apparent difference between the frequency at which sound or light waves leave a source and that at which they reach an observer.

37. Big Bang Model show scientific evidences that the universe once began to expand and continues to expand until today. The following are the evidences, **EXCEPT**.

- A. An explosion that carried matter outward from a point.
- B. Nucleosynthesis as the reaction began with fusion of protons and neutrons forming nuclei.
- C. Hubble expansion which states that other galaxies are moving away relative to the Milky Way at a rate proportional to distance.
- D. Cosmic microwave background is the afterglow of radiation when early stage of the universe was hot and dense then undergo a cooling process.

38. Why is red colour always seen on top while blue is at the bottom of a rainbow?
- Red has a long wavelength so it moves faster and is refracted the least by water droplets in the air.
 - Blue has a long wavelength so it moves faster and is refracted the most by water droplets in the air.
 - Blue has a short wavelength so it moves faster and is refracted the most by droplets of water in the atmosphere.
 - Red has a short wavelength so it moves faster and is refracted the least by droplets of water in the atmosphere.
39. The following reactions take place in the integration of beta decay into an isotope, **EXCEPT**:
- Its atomic number goes up by one.
 - Its mass number remains the same.
 - It emits helium-4 nucleus or alpha particle.
 - It emits an electron in the form of beta particle.
40. Based from the Figure 1 below, what do you think is the factor affecting the chemical reaction not taking place?

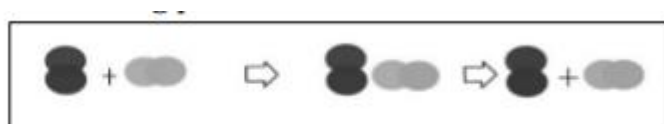


Figure 1. Collision that do not form products

(Source: Physical Science. Collision Theory – Module 8: Collision Theory and Chemical Reaction Rate. First Edition 2020. Published by the Department of Education. Retrieved on 4 December 2021)

- Sufficient Energy
 - Insufficient Energy
 - Wrong Orientation
 - Correct Orientation
41. There is a difference between a disinfectant and a sanitizer. Which of the following supports this statement?
- False, because disinfectants and sanitizers have an equal efficacy against pathogens.
 - False, because sanitizers and disinfectants are often used in healthcare and education settings.
 - True, because disinfectants usually have a greater efficacy against pathogens than sanitizers.
 - True, because sanitizers and disinfectants are designed to kill the types of bacteria that cause foodborne illness.

42. What is the angle of reflection made by a light ray that is incident at 10° on the mirror, as shown in the figure below?

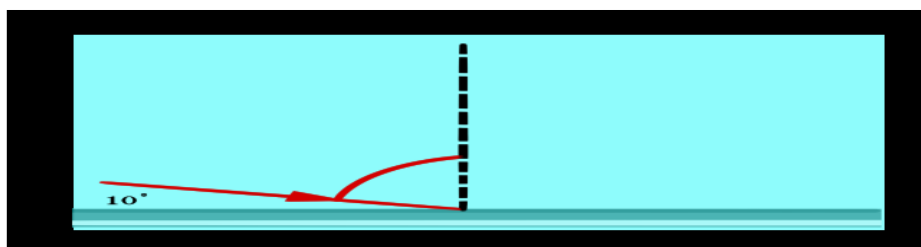
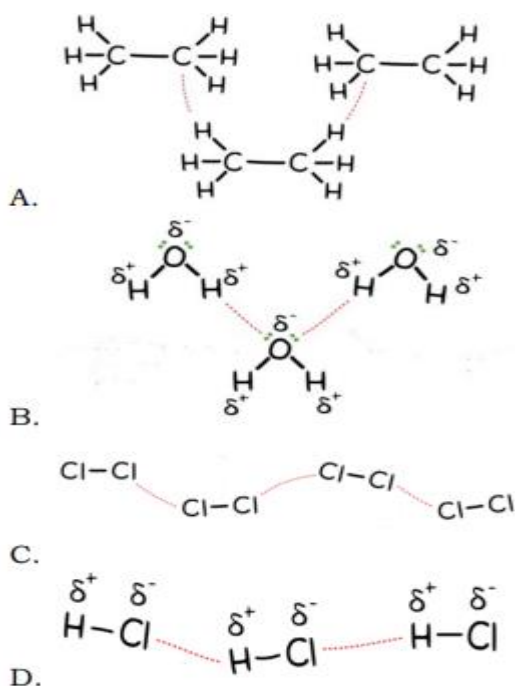


Figure 2. An angle of reflection made by a light ray that is incident at 10° on the mirror

Source: https://www.rpi.edu/dept/phys/ScIT/InformationTransfer/reflrefr/rr_sample/images/rrsam_05_q1.gif

- A. 10°
- B. 80°
- C. 90°
- D. 110°

43. Study the interactions (i.e. red dots) between the molecules below. Which one of the structural representations* shown illustrates dipole-dipole?



44. Illustrate how the process of fission is being observed in using uranium nuclei to heat water.

- A. Uranium atom splits and releases a large amount of heat energy.
- B. Uranium and oxygen collide and releases a large amount of energy.
- C. Uranium atom combined and releases a large amount of heat energy.
- D. Uranium and hydrogen collide and releases a large amount of energy.

45. Arrange the following types of electromagnetic radiation in increasing frequency:

- I. Infrared
- II. Ultraviolet
- III. Visible light
- IV. X-ray

- A. I, II, III, IV
- B. IV, III, II, I
- C. III, I, II, IV
- D. I, III, II, IV

46. Which of the following observations can be seen when you shine a red light in a white paper with red and green dots?

- I. Green dots appear black.
- II. White paper appears white.
- III. Red dots can be still be seen.

- A. I
- B. II
- C. I and II
- D. I and III,

47. Which one of the following describes the geometric shape of iron pentacarbonyl $\text{Fe}(\text{CO})_5$?

- A. Tetrahedral
- B. Trigonal Planar
- C. Trigonal Pyramidal
- D. Trigonal Bipyramidal

48. What does the theory of modern Physics tells us about light?

- A. Demonstrate wave property only
- B. Exclusively shows particle property
- C. It combines wave and particle properties
- D. It has neither wave nor particle properties

49. What measures the relative tendency of an atom to attract electrons to itself when chemically combined with another atom?

- A. Atomic size
- B. Electron affinity
- C. Electronegativity
- D. Ionization energy

50. What phenomenon occurs when colors of a rainbow are seen when light passes through a glass prism?

- A. diffraction of light
- B. dispersion of light
- C. scattering of light
- D. reflection of light