

Name of the Student: \_\_\_\_\_

**Question No. 1. Encircle the correct option.****(20)**

- (1) Leptons are particles that do not experience strong nuclear force. Which of the following are leptons:  
a. electrons                      b. muons                      c. neutrinos                      d. all of these
- (2) During each cycle, a heat engine absorbs 400 J of heat from its high-temperature source and discards 300 J of heat into its lower-temperature sink. The efficiency of this engine is  
a.  $1/3$                       b.  $1/4$                       c.  $1/7$                       d.  $3/7$
- (3) In the fusion process there are  
a. isotopes of oxygen                      b. isotopes of hydrogen                      c. isotopes of helium                      d. none of these
- (4) The temperature of 1 kg hydrogen gas is the same as that of 1 kg of helium gas if  
a. Gasses have same internal energy                      b. gasses radiate energy at the same rate.  
c. The gas molecules have some translation K.E                      d. The gas molecules occupy equal volume
- (5) The mass defect for helium nucleus is 0.0304 amu. The binding energy per nucleon of helium nucleus is  
a. 23.3 MeV                      b.  $200 \times 10$  MeV                      c. 9.31 MeV                      d. 7.075 MeV
- (6) Radioactive materials are stored in lead boxes because lead is  
a. bad conductor                      b. heavy                      c. good absorber                      d. none of these
- (7) The speeds of three molecules of gas are 1, 1 and 4 m/s respectively. The root mean square speed is  
a. 2 m/s                      b. 3 m/s                      c. 6 m/s                      d. 4 m/s
- (8) 273 K on centigrade scale is  
a.  $-15^\circ\text{C}$                       b.  $0^\circ\text{C}$                       c.  $0.15^\circ\text{C}$                       d.  $546^\circ\text{C}$
- (9) Sub atomic particles are divided into  
a. photons                      b. leptons                      c. hadrons                      d. all of these
- (10) The temperature of a body is  $100^\circ\text{C}$ . Its temperature is increased by  $\Delta$  in Kelvin scale. The total temperature in Kelvin is  
a.  $\Delta\theta + 273$                       b.  $\Delta\theta + 100$                       c.  $\Delta\theta + 373$                       d.  $\Delta\theta$
- (11) gray is the SI unit of absorbed dose. 1 gray is equal to  
a.  $1 \text{ J kg}^{-1}$                       b.  $2 \text{ J kg}^{-1}$                       c.  $3 \text{ J kg}^{-1}$                       d.  $4 \text{ J kg}^{-1}$
- (12) First law of thermodynamics is given by  
 $\Delta U = \Delta Q - \Delta W$   
If the ideal gas undergoes a change at constant temp. then which quantity qualities is/are zero.  
a.  $\Delta U$  Only                      b.  $\Delta W$   
c.  $\Delta U$  and  $\Delta W$                       d. None
- (13) In an adiabatic process which of the following remains constant  
a. Volume                      b. Pressure                      c. Temperature                      d. Entropy
- (14) Which of the following is correct for the case of an isothermal expansion of an ideal gas?  
a.  $W > 0$                       b.  $W = 0$                       c.  $\Delta U = 0$                       d.  $Q = 0$
- (15) The internal energy of a fixed mass of an ideal gas depends on  
a. Pressure                      b. Temperature                      c. Volume                      d. Pressure and Volume
- (16) The internal energy is similar to  
a. Gravitational P.E.                      b. Chemical energy                      c. Nuclear energy                      d. None of these
- (17) The sum of all kinds of energies of molecules of gas is called  
a. Binding energy                      b. Internal energy                      c. External energy                      d. Chemical energy
- (18) An adiabatic compression causes the temperature of gas to  
a. Rise                      b. fall                      c. remains constant                      d. Zero
- (19) An ideal reversible heat engine has  
a. 100 % efficiency                      b. Highest efficiency  
c. An efficiency which depends on working substance                      d. All of these
- (20) Which one is irreversible process  
a. Slow compression                      b. Slow evaporation                      c. A chemical explosion                      d. All of these

**Question No. 2 Attempt any twelve questions.****2\*6=12**

- i. What factors make fusion reaction difficult to achieve?
- ii. Describe a brief account of interaction of various types of radiations with matter.
- iii. What are isotopes? What do they have in common and what are their differences?
- iv. What do we mean by the term critical mass?
- v. What is a radioactive tracer? Describe its one application in medicine?
- vi. What information is revealed by the length and shape of the tracks of an incident particle in Wilson cloud chamber?
- vii. Prove that  $1 \text{ u} = 931 \text{ MeV}$
- viii. What do you understand by background radiations? State two sources of these radiations

**Question No. 3**

- a. Describe the construction and working of mass spectrograph. (5)
- b. Find the mass defect and the binding energy for tritium if the atomic mass of tritium is 3.016049 u, mass of proton is 1.007276 u and mass of neutron is 1.008665 u. (3)

**OR****Question No. 4**

- a. Write principle, construction and working of a solid state detector. (5)
- b. The half life of an element is 9.70 hours. Find its decay constant. (3)