Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Level : B.Sc.
Year : II
Course : PHYS 206
Semester: I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date JUN 19 2018

SECTION "A"
[20Q × 1 = 20 marks]

Choose and tick the most appropriate answer.

1. All of the following statements are correct except
   [a] If a gas is expanded adiabatically, then its internal energy will decrease, i.e., the gas will cool down.
   [b] If a gas is compressed adiabatically, then its internal energy will increase, i.e., the gas will get heated.
   [c] If a gas is expanded isothermally, then an amount of heat equivalent to the work done by the gas should be supplied to it from the external source.
   [d] If a gas is compressed isothermally, then an amount of heat equivalent to the work done by the gas should be supplied to it from the external source.

2. The dependence of extraterrestrial solar radiation on time of year (measured on the plane normal to the radiation) is indicated by the equation
   [a] $G = G_{SC}\left[1+0.33\cos\frac{365n}{360}\right]$
   [b] $G = G_{SC}\left[1+0.033\cos\frac{365n}{360}\right]$
   [c] $G = G_{SC}\left[1+0.033\cos\frac{360n}{365}\right]$
   [d] $G = G_{SC}\left[1+0.33\cos\frac{360n}{365}\right]$

3. To maintain the ideal conditions inside the core of the nuclear reactor, appropriate measurement must be taken through
   [a] moderator
   [b] neutron reflector
   [c] fissionable materials (fuels)
   [d] control rods and core cooling

4. Which one of the following range of wavelength in the Sun's radiation is strongly absorbed by the ozone layer?
   [a] 100-200 nm [b] 400-500 nm [c] 190-290 μm [d] 290-300 nm

5. Albedo is defined as the ratio of
   [a] incident radiation to the reflected radiation
   [b] reflected radiation to the incident radiation
   [c] transmitted radiation to the reflected radiation
   [d] absorbed radiation to incident radiation

6. Gamma-rays are
   [a] more ionizing than β-particles
   [b] more ionizing than α-particles
   [c] more penetrating than α-particles
   [d] less penetrating than β-particles

7. A beam of singly charged particles enter a Bainbridge mass spectrometer with a velocity selector having electric and magnetic fields respectively of 3.0×10^5 V/m and 4.0×10^{-2} Web/m^2 . The velocity of the ion emerging from the velocity selector is equal to

[a] 7.5×10^6 m/s [b] 1.2×10^4 m/s [c] 1.33×10^{-6} m/s [d] 2.4×10^7 m/s

8. The intensity of sound wave from a source is 10^{-5} W/m^2. Its loudness in decibel is

[a] 50 dB [b] 70 dB [c] 30 dB [d] 80 dB

9. A hall of volume 5600 m^3 is found to have a reverberation time of 2s. If the area of sound absorbing surface is 700 m^2, the absorption coefficient should be

[a] 0.36 [b] 0.84 [c] 0.64 [d] 0.2

10. Half life of a radioactive substance is 20 min. Difference between points of time when it is 33% disintegrated and 67% disintegrated is approximately

[a] 10 min [b] 20 min [c] 30 min [d] 40 min

Fill in the blanks:

11. The maximum possible efficiency of an ideal heat engine that absorbs heat at 327°C and exhausts heat at 127°C is .....

12. Carrying energy to where it is needed is called distribution while keeping it available until when it is needed is called .....

13. For a HEP station with a head height h and volume flow rate Q, the maximum power output is about ..... kW.

14. A double pane window used for insulating a room from outside, consists of two glass sheets, each of area 1 m^2 and thickness 0.01 m, separated by a 0.05 m thick stagnant air space. In the steady state, the room-glass interface and the glass-outdoor interface are at constant temperatures of 28°C and 0°C respectively. If the thermal conductivities of glass and air are 0.8 and 0.08 W/m/K respectively, the rate of flow of heat through the window pane is about ..... (W).

15. The value of dry adiabatic lapse rate is equal to.....and that of saturated adiabatic lapse rate is.....

16. If two sources of loudness 40 dB are combined, the resultant loudness is equal to.....

17. The physical phenomenon associated to the transport of mass is called .....

18. Curie is a standard unit of measuring radioactivity. One curie is equal to..... disintegrations/s.

19. The mesosphere extends from.....km to.....km in the earth's atmosphere.

20. A light of wavelength 1130 nm is absorbed by a semiconducting material. Its band energy gap should be equal to.....

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SECTION "B"
[5 Q × 4 = 20 marks]

1. Discuss the energy storage and energy distribution (transportation).

2. Explain the working of a refrigerator with its coefficient of performance (COP).

3. Discuss the construction and working of hydrogen/oxygen fuel cell.

OR

What is meant by half-life and decay constant of a radioactive element? A carbon specimen found in a cave contained 1/16 as much C^{14} as an equal amount of carbon in living matter. Calculate the approximate age of the specimen. Half life of C^{14} is 5568 years.

4. Define the term coefficient of thermal conductivity. A sheet of glass has an area of 2.0 m2 and thickness 8.0×10^{-3} m. The glass has a thermal conductivity of 0.8 $Wm^{-1}K^{-1}$. Calculate the rate of heat transfer through the glass when there is a temperature difference of 20 K between its two faces.

OR

What effect would desertification have on albedo of an area of land? What effect would this have on temperature?

5. Define the term lapse rate. Explain why the dry adiabatic lapse rate is always higher than saturated adiabatic lapse rate.

SECTION "C"
[5 Q × 7 = 35 marks]

6. Differentiate energy and exergy. Discuss the loss of exergy in combustion and estimate the loss of exergy with cold reservoir temperature T_C = 300 K and hot reservoir temperature
T_H = 2240 K.

7. Define renewable and non-renewable energy sources with examples. Discuss, in detail, with well labeled diagrams, the solar photovoltaic cell/system.

8. What are the conditions for nuclear fusion? Discuss the nuclear hazards and safety measures.

OR

Describe a nuclear fission reaction with example. What is meant by critical mass for nuclear chain to take place? A nuclear reactor is developing energy at the rate of 100 MW. Calculate the mass of U^{235} which would be used in one day's operation assuming that on an average energy of 200 MeV is released per fission

9. Describe the different layers of earth's atmosphere with a well labeled diagram. How does the temperature and pressure vary with altitude in each layer?

10. Describe the principle, structure and function of a Geiger Muller counter with the help of a well labeled diagram. What is meant by efficiency of such a counter?

OR

What is noise? How is it measured? Describe the auditory and non-auditory effects of noise pollution. Briefly explain the methods of controlling noise.