KATHMANDU UNIVERSITY
End Semester Examination
March/April 2017

Marks Scored:

Level : B.Sc.
Year : II
Course : PHYS 206
Semester: I
Exam. Roll No.: Time : 30 mins. F.M. : 20
Registration No.: Date : APR 11 2017

SECTION "A"
[2Q.×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 power available in the wind is
   [a] proportional to the air density, rotor diameter and wind speed.
   [b] proportional to the air density, rotor diameter and square of the wind speed.
   [c] proportional to the air density, square of the rotor diameter and cube of the wind speed.
   [d] proportional to the air density, square of the rotor diameter and square of the wind speed.

3. Heavy water is used as a moderator in a nuclear fission reactor. The function of the moderator is
   [a] to cool down the reactor
   [b] to control the energy released in the reactor
   [c] to slow down the neutron to thermal energies
   [d] to absorb neutrons and stop the chain reaction

4. Heat radiation refers to
   [a] long wavelength radiation
   [b] short wavelength radiation
   [c] movement of heat energy particles
   [d] none of the above

5. Which one of the following range of a wavelength in solar radiation is most likely to be absorbed by ozone layer?
   [a] 700-1000 nm [b] 290-300 nm [c] 300-500 nm [d] 400-750 nm

6. Greenhouse effect refers to an increase in
   [a] carbon monoxide
   [b] average global temperature
   [c] atmospheric pressure
   [d] greenery

7. Half-life of thorium is 1.4×10^{10} years. The time required for 10% of a sample of thorium to disintegrate is equal to
   [a] 1.4×10^{8} years
   [b] 1.4×10^{9} years
   [c] 2.1×10^{9} years
   [d] 7×10^{8} years

8. A radioactive nucleus ${}_{Z}X^{A}$ emits a beta-particle. The new nucleus formed after the decay is represented by
[a] ${}_{Z-1}X^{A}$ [b] ${}_{Z+1}X^{A}$ [c] ${}_{Z}X^{A}$ [d] ${}_{Z-2}X^{A-4}$

9. Diffusion is the phenomena associated with the transport of
[a] momentum [b] mass [c] energy [d] power

10. A 10 phon response is produced by
[a] 10 dB sound at 1000 kHz [b] 10 dB sound at 1000 Hz
[c] 100 dB at 1 kHz [d] 10 dB at 20 kHz

11. If two sources of loudness 40 dB are combined, the resultant loudness is equal to
[a] 80 dB [b] 20 dB [c] 43 dB [c] 46 dB

12. A positively charged particle projected towards east is deflected towards north by a magnetic field. The field must be directed
[a] towards west [b] towards south [c] upward [d] downward

13. In Thomson's parabola method for the analysis of positive ray,
[a] the particles of largest E/M will lie along the outermost parabola
[b] the particles of smallest E/M will lie along the outermost parabola
[c] the particles of largest E/M will lie along the innermost parabola
[d] particles of all possible values of E/M will lie along the same parabola

14. When an atom emits γ-rays
[a] its mass number decreases by two [b] mass number increases by one
[c] its atomic number increases by one [d] atomic and mass number remain unchanged

15. Which one of the following statements is true?
[a] dry adiabatic lapse rate is always higher than saturated adiabatic lapse rate
[b] dry adiabatic lapse rate is always lower than saturated adiabatic lapse rate
[c] dry adiabatic lapse rate is always equal to saturated adiabatic lapse rate
[d] dry adiabatic lapse rate can be higher or lower than saturated adiabatic lapse rate depending upon the atmospheric stability

Fill in the blanks:

16. An inertial force that acts on objects that are in motion relative to a rotating reference frame is called.....

17. When the distance from the source of a sound is doubled, the loudness of the sound decreases by ..... dB.

18. If the efficiency of a Carnot engine is found to increase from 0.3 to 0.4 when the temperature of the sink is lowered by 50 K, then the original temperature of the sink is ..... K.

19. 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).

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

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SECTION "B"
[5 Q.×4=20 marks]

1. Describe the different layers of earth's atmosphere and highlight the importance of ozone layer.

OR

Write short notes on (a) global warming (b) albedo

2. Explain the terms decay constant and half life of a radioactive substance. A carbon specimen found in a cave contained 1/4 as much C^{14} as an equal amount of carbon in living matter. Calculate the approximate age of the specimen. (Given: Half life period of C^{14} is 5570 years)

3. Describe the principle, structure and working of a solid state detector of nuclear radiation. What are its main advantages over the detectors based on ionization of gases?

OR

What is noise? How is it measured? Outline methods of controlling noise pollution.

4. What is the basic principle used in a refrigerator? An ideal refrigerator takes heat from water at 0°C and transfers it to a room at 27°C. If 100 kg of water is to be changed into ice at 0°C, determine the required work in joules. (Latent heat of ice = 3.4×10^5 J/kg)

OR

A point source emits sound waves with average output of 20 W. Find (a) the intensity 2 m away from the source (b) the distance at which the sound level is 40 dB.

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

SECTION "C"
[5 Q.×7=35 marks]

6. Derive an expression for the power developed (available) due to wind. Estimate the amount of energy release during combustion of natural oil (petroleum) and hence find out the energy content in it in kJ/gm. (Bond energy in kJ/mole for C–C, C–H, O–H, O=O and C=O are 347, 410, 460, 494 and 799 respectively)

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

OR

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

8. What is a mass spectrograph? Describe Bainbridge mass spectrograph and explain how atomic masses are determined with it. Mention the important advantage of this type of spectrograph.

9. What do you mean by radiation inversion? Give a brief account of the different shapes of plumes and atmospheric stability.

10. Distinguish between nuclear fission and fusion. A nuclear reactor is developing energy at the rate of 2000 KW. 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.