KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Mark scored:

Level : B.Sc.
Year : II

Course : PHYS 206
Semester: I

Exam. Roll No.:

Time: 30 mins.

F.M. : 20

Registration No.:

Date : MAR 1 8 2018

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and tick the most appropriate answer.

1. Heat given to an ideal gas under isothermal conditions is used
   [a] in doing the external work
   [b] in increasing the temperature
   [c] in increasing the internal energy
   [d] in increasing the temperature and doing the external work

2. For a HEP station with a head height h and volume flow rate Q, the maximum power output is about
   [a] Qh (W) [b] Qh (kW) [c] 10Qh (W) [d] 10Qh (kW)

3. Nuclear power plant workers should be constantly monitored
   [a] for nuclear waste disposal
   [b] for proper emergency response
   [c] for any over exposure of nuclear radiation
   [d] to separate them from outside environment

4. Most of the weather phenomena take place in
   [a] mesosphere [b] troposphere [c] stratosphere [d] ionosphere

5. Which one of the following surfaces has the highest albedo?
   [a] dark soil [b] fresh snow [c] thick cloud [d] deciduous forest

6. Ozone layer is responsible for the absorption of radiation in the sun light in the range of
   [a] 190 – 200 nm [b] 290 – 300 nm [c] 450 – 600 nm [d] 600 – 750 nm

7. An alpha particle is bombarded on N^{14}. As a result O^{17} nucleus is formed and a particle is emitted. This particle is a
   [a] proton [b] neutron [c] electron [d] positron

8. The half life of a radioactive nucleus is 20 Hrs. The time after which one fourth of the original activity of the sample will remain is
   [a] 20 Hrs [b] 40 Hrs [c] 60 Hrs [d] 80 Hrs

9. The intensity of a sound from a jet plane is 10^{-7} W/m^2. The intensity level of this sound is
   [a] 50 dB [b] 60 dB [c] 90 dB [d] 100 dB

10. A standard reverberation time is the time for the sound to die away to a level
    [a] 40 dB below its original level [b] 50 dB below its original level
    [c] 60 dB below its original level [d] none of these

Fill in the blanks.

11. A beam of ions enter a Bainbridge's mass spectrograph with a velocity selector having electric and magnetic fields 30 kV/m and 0.3 Tesla respectively. The velocity of the ion emerging from the selector is _____.

12. Temperature inside a room is 25°C and outside is 10°C. The amount of heat that will leave the room in 20 mins through a glass window (K = 0.002 c.g.s unit) 2 m long, 1 m wide and 0.04 m thick is _____.

13. 1 Curie is equal to _____ disintegrations/s.

14. During the simulation of convective energy loss, a student volunteer with surface area 1.8 m^2 and skin temperature 31°C is placed in a flow of water with temperature 12°C and velocity 0.5 m/s. If the convective energy transfer coefficient is 34.4 $W/m^2/K$, the rate of convective energy loss is about _____ W.

15. If a fluid is forced to move by a pump or a fan to make the heat exchange more efficient, then it is called _____.

16. If an ideal refrigerator has to transfer an average of 263 J of heat per second from –10°C to 25°C, then the average power consumed is about _____ W.

17. A renewable energy source that does not originate from the sun is _____ energy.

18. On 2nd of July, the extraterrestrial solar radiation G (measured on the plane normal to the radiation) has a value of about _____ (W/m^2). (G_{sc} = 1353 W/m^2)

19. The wind speed is reduced to one-fourth of its original speed. Power available remains the same if the diameter of the rotor is increased by _____ times.

20. Nuclear waste recycling is a new waste disposal method in which the fission products are separated into different streams using _____.

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Time : 2 hrs. 30 mins.

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SECTION "B"

[5 Q. × 4 = 20 marks]

1. What is meant by lapse rate? Explain why the dry adiabatic lapse rate is higher than saturated adiabatic lapse rate.

OR

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

2. What is noise? How is it measured? Briefly describe the effects of noise on human health.

3. Write a short note on ozone layer and its importance. Describe the main causes for depletion of ozone layer.

4. Define the terms direct, diffuse and global solar radiation. Discuss the variation of extraterrestrial solar radiation.

OR

Derive an expression for the power developed (available) due to wind.

5. Discuss the nuclear waste disposal and safety measures.

SECTION "C"

[5 Q. × 7 = 35 marks]

6. Discuss the energy from fossil fuel and estimate the amount of energy release during combustion of natural gas (methane) and hence find out the energy content in it in kJ/gm. (Bond energy in kJ/mole for C–H, O–H, O=O and C=O are 410, 460, 494 and 799 respectively)

7. Define entropy. Find out an expression for the maximum thermal efficiency or Carnot efficiency of an ideal heat engine, and discuss the loss of exergy in combustion.

OR

Describe, in detail, the working of a nuclear fission reactor with a well labeled diagram.

8. Describe the principle and working of a solid state detector of nuclear radiation. What are the advantages of such detector over the detectors based on gas ionization chamber?

9. Explain the terms decay constant (λ) and half-life ($T_{1/2}$) 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. Half-life period of C^{14} is 5730 years.

10. What is a mass spectrograph? Describe the construction of Aston's mass spectrograph with necessary theory and show how it can be used in the detection of isotopes. State the limitations of this mass spectrograph.

OR

Distinguish between chemical reaction and nuclear reaction with suitable examples. It is given that the energy released by fission of a single U^{235} nucleus is 200 MeV. Calculate the energy released by fission of 1 kg of U^{235}.