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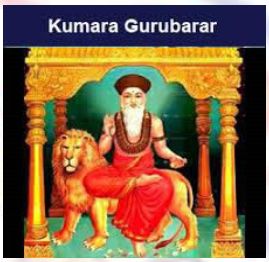

QUESTIONBANK

Title of the Paper

THERMAL PHYSICS

Course:II B.Sc Physics

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CORE COURSE III
THERMAL PHYSICS

Objective : To understand the phenomena connected with heat as radiation, conduction, different thermal capacities of substances and the converse process of making heat to do mechanical work.

UNIT I

Specific Heat Specific heat of solids – Method of mixtures – radation correction – Dulong and Petit's law - Quantum theory - Einstein's theory of specific heat – Debye's theory of specific heat– Specific heat of liquids – Newton's law of cooling - Specific heat of gases – Mayer's Relation – Quantization of various contributions to energy of diatomic molecules – Specific heat of diatomic gases.

UNIT II

Conduction. Coefficient of Thermal Conductivity - Rectilinear Flow of Heat along a Bar - Thermal conductivity of good conductors - Lee's method for metals – Forbe'smethod to find K – Lee's disc method for Bad Conductors – Heat Flow Through a Compound wall – Accretion of Ice on Ponds – Wiedemann-Franz law – Practical applications of conduction of heat.

UNIT III

Radiation Radiation – Stefan's law - Deduction of Newton's law from Stefan's law – Boltzmann's law – Block body radiation – Wein's law – Rayleigh-Jean's law – Planck's law – Angstrom Pyrheliometer – Solar constant – Surface temperature of sun - Sources of solar energy – Photo voltaic cell – Greenhouse effect.

UNIT IV

Low Temperature Joule – Thomson's effect – Porous plug experiment – Liquefaction of gases –Linde's method – Liguefaction of hydrogen - Adiabatic demagnetization – Liquefaction of He – Practical applications of low temperature – Refrigerating mechanism – Air conditioning mechanism – solid carbon dioxide(dry ice).

UNIT V

Thermodynamics Zeroth law of thermodynamics – First law of thermodynamics – Heat engines – Reversible and irreversible process - Carnot's theorem – Second law of thermodynamics - Thermodynamic Scale of temperature – Entropy – Change of entropy in reversible and irreversible processes – Temperature – entropy diagram (T.S) – Law of increase of entropy – Maxwell's thermo dynamical relations – Clausius' - Claypeyron's latent heat equations.

Books for Study:

1. BrijlalandSubramaniyam, Heat and Thermodynamics, S. Chand &Co., 2001.
2. J. B. Rajamand C. L Arora, Heat and Thermodynamics, S. Chand & Co.1983.
3. BrijlalandSubramaniyam, Heat and Thermodynamics & Statistical physics, S. Chand & Co. 2015.

Books for Reference:

1. M. Narayanamoorthy and N. Nagarathinam, Heat, National publishing Co, Chennai, Eight edition, 1987.
2. D.S. Mathur, Heat and Thermodynamics, S. Chand & Co. 2014.

UNIT- I
SPECIFIC HEAT

CHOOSE THE CORRCT ANSWER

1. The amount of heat required to raise the temperature of 1kg of water 1°C is
    a. 252 calories
    b. 2.52 calories
    c. 1kg calorie
    d. 453.6 calories

2. The specific heat raise the temperature of unit mass of a substance through one degree is
    a. $c=H/m\theta$
    b. $c= MH\theta$
    c. $c=H\theta$
    d. $c=H/\theta$

3. The unit of specific heat is
    a. 1°C
    b. 1°F
    c. g°C
    d. Calorie/g°C

4. The thermal capacity is
    a. 1/m
    b. H/m
    c. mc Calories/C°
    d. 1°C

5. The derivation of water equivalent is
    a. w=mc grams
    b. $w= mc\theta$
    c. $w=c\theta$
    d. $w=m\theta$

6. Regnault's final temperature of the____ is noted
    a. Equivalent
    b. Mixture
    c. Different
    d. Minimized

7. The Newton's law of cooling final derivation form.
    a. $-dH/dt=k(\theta-\theta_0)$
    b. $dH/dt=k(\theta-\theta_0)$
    c. $dH/dt=k(\theta_0-\theta_1)$
    d. $dH/dt=k(\theta_1-\theta_2)$

8. The thermal capacity of each Calorimeter is numerically equal to the volume of either liquid
    a. 10 minutes
    b. 20°C
    c. 3.418 minutes
    d. 0.6 Calorie/g-k

9. The final derivation of Mayer's relation is
    a. pv=tT
    b. bdv=rdT
    c. w=pdv
    d. $C_p-C_v=R/J$

10. The difference between atomic heats and absolute temperature is
    a. $A=f(\theta/T)$
    b. $A\propto T^3$
    c. $A=C_H$
    d. $A=M\rho V$

ANSWERS:

1) c 2) a 3) d 4) c 5) a 6) b 7) a 8) d 9) d 10) a

TWO MARKS

11. Give the definitions Specific heat of solids.
12. What is Thermal capacity?
13. What is temperature of the mixture?
14. Give the Nernst's vacuum calorimeter.
15. What is Joule's Electrical method?
16. Give the Callendar and Barnes continuous flow method.
17. Give the specific heat of a gas various from zero to infinity.
18. Give the relation between C_p,$C_v$and R.
19. What is pressure gauge?
20. Give the Bomb calorimeter.

FIVE MARKS

21. Explain specific heat of solids.
22. Explain method of mixtures.
23. Explain Radiation correction.
24. Explain Dulong and Petit's law.
25. Explain Debye-Einstein theory.
26. Explain Regnault's method.
27. Explain temperature and time for water and the liquid.
28. Discuss the C_p and C_v.
29. Explain product of the specific heat.
30. Discuss the variation of specific heat and Atomic heat with temperature.

TEN MARKS

31. Briefly explain Quantum theory.
32. Discuss the Einstein's theory of specific heat.
33. Discuss the Debye's theory of specific heat.
34. Briefly explain specific heat of liquids.
35. Discuss the Newton's law of cooling.
36. Discuss the specific heat of gases.
37. Explain Mayer's relation.
38. Explain Quantization of various contributions.
39. Discuss the energy of diatomic molecules.
40. Discuss the specific heat of diatomic gases.

UNIT- II
CONDUCTION

CHOOSE THE CORRECT ANSWER

1. The pressure, volume, temperature and entropy prove the relation is
    a. Maxwell's thermo dynamical relations
    b. Helmholtz thermo dynamical relations
    c. Gibb's thermo dynamical relations
    d. Clapeyron's thermo dynamical relations

2. The quantity of heat conducted across the __ opposite faces is
    a. One
    b. Two
    c. Three
    d. Five

3. The dimensions of k is
    a. $k=MLT^{-3}\theta^{-1}$
    b. $k=-Qdx/Ad\theta t$
    c. $k= ML^2T^{-2}$
    d. $k=d\theta/dx$

4. The thermal diffusivity is
    a. $h=k/\rho s$
    b. $h= ms/V$
    c. $h=k/V$
    d. $h= k/\rho$
5. Rectilinear flow of heat along a bar steady the derivation is
    a. $Q= kA\ (d^2\theta/dx^2)\delta x$
    b. $Q= Q_1-Q_2$
    c. $Q= (d\theta/dx)\delta x$
    d. $Q= kA$

6. The rectilinear flow of heat along a bar of ___ area of cross-section is
    a. Uniform
    b. Non-uniform
    c. Depression
    d. Mid-point

7. After the steady state is reached general solution of this equation is
    a. $\theta=Ae^{\mu x}$
    b. $\theta= Be^{\mu x}$
    c. $\theta=Ae^{-\mu x}$
    d. $\theta= Ae^{+\mu x}+Be^{-\mu x}$

8. Fobes method to find 'k' determined relations are
    a. $k= \rho Adx$
    b. $k= \rho Adx\ S\ d\theta/dt$
    c. $k= \rho A(d\theta/dx)$
    d. $k = \frac{\rho S \int_B^C \left(\frac{d\theta}{dt}\right) dx}{\left(\frac{d\theta}{dx}\right)_B}$

9. The Lee's method for liquids relation is
   a. $\frac{kA(\theta_1-\theta_2)}{d}$
   b. $\frac{k_1A_1(\theta_3-\theta_4)}{d_1}$
   c. $\frac{k_2A_2(\theta_3-\theta_4)}{d_1}$
   d. $\frac{kA(\theta_1-\theta_2)}{d}=\frac{k_1A_1(\theta_3-\theta_4)}{d_1}+\frac{k_2A_2(\theta_3-\theta_4)}{d_1}$

10. The heat flow through a compound wall general relation is
   a. $Q = A(\theta_1 - \theta_2)$
   b. $Q = \frac{d_1}{k_1} + \frac{d_2}{k_2}$
   c. $Q = \frac{A(\theta_1-\theta_2)}{\Sigma(\frac{d}{k})}$
   d. $Q = kA(\theta_1 - \theta_2)$

ANSWERS:

1) a 2) b 3) b 4) a 5) a 6) a 7) d 8) d 9) d 10) c

TWO MARKS

11. What is Conduction?
12. What is Convection?
13. What is Radiation?
14. Give the temperature gradient.
15. Give the thermal diffusivity.
16. State the heat lost by radiation is negligible.
17. State that after the steady state is reached.
18. Give the Bar is of infinite length
19. Give the Bar is of finite length L, the boundary conditions are.
20. State the Dewar's flask.

FIVE MARKS

21. Explain coefficient of thermal conductivity.
22. Explain Transmission of heat.
23. Explain static experiment.
24. Explain dynamic experiment.
25. Explain absolute conductivity of the material.
26. Explain the thermal conductivity of poor conductors.
27. Explain Charlton's method for bad conductors.
28. Explain coefficients of thermal conductivity of the two materials.
29. Explain thermal conductivity and electrical conductivity of metals.
30. Explain Davy's safety lamp.

TEN MARKS

31. Explain rectilinear flow of heat along a bar.
32. Briefly explain thermal conductivity of good conductors.
33. Briefly explain Lee's method for metals.
34. Explain Forbe's method to find 'k'.
35. Explain Lee's disc method for bad conductors.
36. Explain heat flow through a compound wall.
37. Explain accretion of Ice on ponds.
38. Briefly explain Wiedemann law.
39. Briefly explain franz's law.
40. Explain practical applications of conduction of heat.

UNIT- III
RADIATION

CHOOSE THE CORRECT ANSWER

1. The heat radiations also form a part of the spectrum is
    a. Magnetic
    b. Electrical
    c. Gravity
    d. Electromagnetic

2. The derivation of Newton's law of cooling is
    a. $R=\sigma T$
    b. $R=T^4$
    c. $R=T_1-T_2$
    d. $R\propto(T_1-T_2)$

3. The product of the wavelength corresponding to maximum energy and absolute temperature is constant this relation is
    a. Wien's law
    b. Newton's law
    c. Stefan's law
    d. Boltzmann's law

4. The final relation of Wien's displacement law is
    a. $E_\lambda=\lambda_m XT$
    b. $E_m \propto T^3$
    c. $E_m=T^5$
    d. $E_\lambda=C_1\lambda^{-5}e^{(C_2/\lambda T)}$

5. The relation of solar constant is
    a. $S=S_0A$
    b. $S=S_0A^{\sec z}$
    c. $S=S_0$
    d. $S=S_0a^{\sec z}$

6. The photosphere has a temperature is
    a. 1000k
    b. 2000k
    c. 6000k
    d. 5000k
7. The derivation of Angstrom's pyrheliometer is
    a. A=A sq cm
    b. A=H AaCalories
    c. A=R/r
    d. HAa=$\frac{EI\times 60}{4.2}$

8. The region of longer wavelength but not for shorter wavelengths relation is
    a. Rayleigh Jean's law
    b. Ruben's law
    c. Kurlbaum law
    d. Wien's law

9. The Planck's constant is
    a. A
    b. D
    c. k
    d. h

10. The Black body hole will act as a
    a. Absorber
    b. Emitter
    c. Radiator
    d. All of these

ANSWERS:

1) d 2) d 3) a 4) d 5) d 6) c 7) d 8) a 9) d 10) d

TWO MARKS

11. State the Radiation.
12. State the Stefan's-Boltzmann law.
13. Give the all temperatures of a hot body.
14. Give the Lummer and Pringsheim.
15. Give the total radiation pyrometer.
16. Give the wavelength corresponding to maximum energy and absolute temperature.
17. State the basis of quantum theory.
18. Give the pyrheliometers.
19. Give the advantages of photo voltaic cell.
20. Give the advantages of greenhouse effect.

FIVE MARKS

21. Explain the Stefan's law.
22. Explain the Wien's law.
23. Explain the Rayleigh-Jean's law.
24. Discuss is true when the difference of temperature.
25. Discuss the Black body absorber.
26. Discuss the Black body emitter.
27. Explain the water flow pyrheliometer.
28. Explain the fundamental frequency of the resonator.
29. Explain the angular elevation of the Sun.
30. Explain the effective temperature of the Sun.

TEN MARKS

31. Explain deduction of Newton's law from Stefan's law.
32. Briefly explain Boltzmann's law
33. Explain Black body radiation.
34. Briefly explain Planck's law.
35. Explain Angstrom pyrheliometer.
36. Briefly explain Solar constant.
37. Explain surface temperature of Sun.
38. Briefly explain sources of Solar energy.
39. Briefly explain photo voltaic cell.
40. Briefly explain greenhouse effect.

UNIT- IV
LOW TEMPERATURE

CHOOSE THE CORRECT ANSWER

1. The total random kinetic energy of 1 gram molecule of nitrogen at 300k, is
    a. 4,335 Joules
    b. 1,235 Joules
    c. 3,735 Joules
    d. 3,335 Joules

2. The average kinetic energy of a hydrogen molecule at 27°C is
    a. 6.21×10^{-14}ergs
    b. 1.11×10^{-14}ergs
    c. 2.11×10^{-14}ergs
    d. 3.11×10^{-14}ergs
3. The total random kinetic energy of 2 grams of nitrogen at 27°C is
    a. 366.8 Joules
    b. 266.8 Joules
    c. 466.8 Joules
    d. 566.8 Joules

4. The total random kinetic energy of 8 grams of helium at 200k, is
    a. 100 joules
    b. 300 joules
    c. 400 joules
    d. 4,980 joules

5. The r.m.s velocity of a mercury atom at 1,200k is
    a. 5 cm/s
    b. 11 cm/s
    c. 110 cm/s
    d. 3.86×10^4 cm/s

6. Theory of Porous plug experiment consider below the Boyle temperature is
    a. pv=w
    b. $p_1v_1 < p_2v_2$
    c. $p_1v_1 = p_2v_2$
    d. $p_1v_1 = 0$

7. Joule-Kelvin effect-Temperature of Inversion following the equation, is
    a. Joule-Kelvin equation
    b. Andrew's equation
    c. Van der waal's equation
    d. Holborn's equation

8. Relation between Boyle temperature is
    a. T=2a/Rb
    b. T>2a/Rb
    c. T_B=a/Rb
    d. T<2a/Rb

9. Relation between temperature of Inversion is
    a. T_i=2a/Rb
    b. T=a/Rb
    c. T=2/Rb
    d. T_i>2a/Rb

10. Relation between critical temperature is
    a. T=a/Rb
    b. T_c=8a/27Rb
    c. T_c=4a/27Rb
    d. T_c<8a/Rb

ANSWERS:

1) c 2) a 3) b 4) d 5) d 6) b 7) c 8) c 9) a 10) b

TWO MARKS

11. State the low Temperature.
12. Give the Thermometer.
13. What is the Boyle temperature?
14. State and explain Van der Waal's equation.
15. What is Joule-Thomson effect?
16. What you mean by degrees of freedom.
17. State the law of equipartition of energy.
18. What is dry ice?
19. Give the Refrigerator.
20. Give the regulator.

FIVE MARKS

21. Explain Joule-Thomson's effect.
22. Explain the experimental arrangement of the Cascade process for the liquefaction of oxygen.
23. Describe Claude's process for the liquefaction of air.
24. Discuss K. onne's method for the liquefaction of helium.
25. Explain the properties of helium I & II.
26. Describe the methods for the liquefaction of hydrogen and helium using Joule-Thomson effect.
27. Describe with necessary theory, the method of adiabatic demagnetisation for producing very low temperatures.
28. Describe the method to measure such low temperatures.
29. Discuss an account of liquefaction of gases.
30. Explain the Electrolux refrigerator.

TEN MARKS

31. Describe the Porous plug experiment.
32. Briefly explain Liquefaction of gases.
33. Briefly explain Linde's method.
34. Explain the Liquefaction of Hydrogen.
35. Discuss the adiabatic demagnetization.
36. Briefly explain Liquefaction of Helium.
37. Describe the practical applications of low temperature.
38. Briefly explain Refrigerating mechanism.
39. Briefly explain Air conditioning mechanism.
40. Discuss the solid Carbon-dioxide (dry ice).

UNIT- V
THERMODYNAMICS

CHOOSE THE CORRECT ANSWER

1. The first law of Thermodynamics mathematically relation is
   a. δH=dv+δw
   b. δH=δw
   c. H=w
   d. $\oint \delta H = \oint \delta W$

2. The second law of thermodynamics gives the conditions under which heat can be converted into
   a. Force
   b. Temperature
   c. Work
   d. Capacity

3. _____ should be at a fixed high temperature.
   a. Source
   b. Stand
   c. Heat
   d. Insulated

4. ____ should be at a fixed lower temperature.
   a. Pressure
   b. Volume
   c. Sink
   d. Isothermal

5. The Carnot's engine is perfectly process is
   a. Reversible
   b. Irreversible
   c. Adiabatic
   d. Refrigerator

6. The efficiency of the Carnot's engine working between the Stream point and Ice point and using the formula
   a. $\eta=T_2/T_1$
   b. $\eta =1-T_2/T_1$
   c. $\eta =T_1/T_2$
   d. $\eta =T_1T_2$

7. The efficiency of the Carnot's engine working between 127°C and 27°C, % efficiency
    a. %η =25%
    b. η=50
    c. η=100
    d. %η=27%

8. The theory of absolute scale is
    a. Carnot's
    b. Kelvin's
    c. Rankine
    d. Otto

9. It θ_1 is zero, T_1 is also zero, it means the two scales are identical at absolute_____ temperature.
    a. Five
    b. Two
    c. One
    d. Zero

10. Internal combustion Engine is
    a. Diesel engine
    b. Petrol engine
    c. Multi cylinder engine
    d. Heat engine

ANSWERS:

1) a 2) c 3) a 4) c 5) a 6) b 7) a 8) b 9) d 10) b

TWO MARKS

11. What is Thermodynamics?
12. Give the Heat engines advantages.
13. Give the entropy diagram drawbacks.
14. What is Insulating?
15. Give the Refrigerator advantages.
16. Give the efficiency of a Carnot's engine working between 600k and 300k.
17. State the effect of change of pressure on the melting point.
18. State the effect of change of pressure on the boiling point.

19. State the multi cylinder Engines.
20. Give the reversible and irreversible advantages.

FIVE MARKS

21. Explain Zeroth law of thermodynamics.
22. Deduce the first law of thermodynamics.
23. Derive the heat engines.
24. Describe Reversible process.
25. Describe irreversible process.
26. Explain fully temperature.
27. Describe the law of increase of entropy.
28. Describe a reversible heat engine and find an expression for its efficiency.
29. Explain the concept of entropy.
30. Deduce Clausius Inequality.

TEN MARKS

31. Briefly explain Reversible and irreversible process.
32. Briefly explain Carnot's theorem.
33. Discuss the second law of thermodynamics.
34. Explain thermodynamic scale of temperature.
35. Briefly explain Entropy.
36. Describe the change of entropy in reversible process.
37. Describe the change of entropy in irreversible process.
38. Briefly explain entropy diagram (T.S).
39. Briefly explain Maxwell's thermo dynamical relations.
40. Briefly explain Claypeyron's latent heat equtions.