MLFO Mid Semester Exam Feb 2022 (Div - G)

Department of Physics, SVNIT Surat 395007

* Required

1. Name *

    _____

2. Roll number *

    _____

    Instructions

    1- Use Institute id for login. Multiple log in is not allowed.
    2- Once login from any device. Do not Switch the device in between the examination.
    3- Make sure the log in device is fully functioning during the examination with proper internet connection.
    4- Camera must be ON during the whole examination.
    5- All the questions are mandatory
    6- Submit the response in a given time frame.
    7- Late submission will not be considered in any circumstances.

3. 1. Ratio of probabilities of spontaneous emission and stimulated emission is   1 point
    *

    Mark only one oval.

    ( ) proportional to frequency v

    ( ) Independent of frequency v

    ( ) proportional to v2

    ( ) proportional to v3

4.   2. Calculate the coherence length of a fluorescent lamp emitting white light   1 point
      (4000Å to 7000Å). *

Mark only one oval.

⬭ 5040Å

⬭ 6000Å

⬭ 4500 Å

⬭ 4345 Å

5.   3. Find the ratio of population of two states in a HeNe laser that produces a   1 point
      wavelength λ = 6328 Å at 27°C = 300 K. *

Mark only one oval.

⬭ 1.8×10^{-33}

⬭ 1.1×10^{-33}

⬭ 0.1×10^{-33}

⬭ 2.1×10^{-33}

6.   4. In a material at 400 K two energy levels have a wavelength separation of   1 point
      2.5 µm. Determine the ratio of upper to lower energy level occupation
      densities (N2/N1) when the material is in thermal equilibrium *

Mark only one oval.

⬭ 1.4×10^{-21}

⬭ 5.5×10^{-7}

⬭ 1.4×10^{-7}

⬭ 5.5×10^{-21}

7. 5. The optical feedback provided by the cavity mirrors *   1 point

Mark only one oval.

○ Changes the wavelength of laser beam

○ Increases the lifetime of emission

○ Effectively increases the length of the optical medium

○ All of the above

8. 6. If there are 'N' atoms in a source, each emitting light with intensity 'I',   1 point
then the total intensity produced by an ordinary source is proportional to
'NI', whereas in a laser source, it is proportional to........ *

Mark only one oval.

○ $(NI)^2$

○ $2NI$

○ NI^2

○ N^2I

9. 7. A laser source has a wavelength 7000Å and aperture 5 mm. The laser   1 point
beam is sent to the moon, the distance of which from the earth is 4 x 108
m. what is the angular spread and area of spread when the beam reaches
to the moon. *

Mark only one oval.

○ 3×10^{-4} rad, $4.45 \times 10^{10} m^2$

○ 1.7×10^{-4} rad, $1.45 \times 10^{10} m^2$

○ 2.3×10^{-6} rad, $3.45 \times 10^{12} m^2$

○ 5.3×10^{-6} rad, $6.45 \times 10^{12} m^2$

10.   8. A typical He-Ne laser emits radiation of λ= 6328Å. How many photons   1 point
      per second would be emitted by a one milli-watt He-Ne laser? *

Mark only one oval.

( ) 3 x 10^{20}

( ) 3 x10^{15}

( ) 3x10^{19}

( ) None

11.   9. He-Ne laser utilizes *   1 point

Mark only one oval.

( ) Three level pumping scheme

( ) Four level pumping scheme

( ) Two level pumping scheme

( ) None

12.   10. Sodium D1 line has wavelength 5890 Å with spectral width 0.1 Å.   1 point
      Determine its coherent length, coherent time and Q value. *

Mark only one oval.

( ) 3.47 cm, 1.18 x 10^{-10} s, 58900

( ) 1.23 cm, 1.18 x 10^{-10} s, 5890

( ) 3.47 cm, 3.27 x 10^{-10} s, 589

( ) 6.67 cm, 1.18 x 10^{-20} s, 58900

13. 11. The Lagrangian function is defined by _____. *   1 point

Mark only one oval.

- ( ) L= F + V
- ( ) L= T − V
- ( ) L = T + V
- ( ) L = F − V

14. 12. The generalized coordinates *   1 point

Mark only one oval.

- ( ) depend on each other
- ( ) are independent of each other
- ( ) are necessarily spherical co-ordinates
- ( ) None of these

15. 13. If the generalized coordinates had the dimension of velocity then   1 point
generalized velocity has a dimension of *

Mark only one oval.

- ( ) Acceleration
- ( ) Force
- ( ) Torque
- ( ) Momentum

16.   14. Lagrange's equation of motion of an electrical circuit comprising an   1 point
        inductance L and capacitance C (the condenser is charged to q coulombs
        and the current owing in the circuit is I amperes) is *

Mark only one oval.

- ( ) q̈+q/LC=0
- ( ) q̈+Lq/C=0
- ( ) q̈+Cq/L=0
- ( ) q̈+q²/LC=0

17.   15. For Lagrangian of any system, which of the following is true *   1 point

Mark only one oval.

- ( ) L=L(pk,qk,t)
- ( ) L=L(qk,q˙k,t)
- ( ) L=L(pk,pk,t)
- ( ) L=L(pk,p˙k,t)

18.   16. Virtual displacement means in the sense that *   1 point

Mark only one oval.

- ( ) It occurs in a finite time interval
- ( ) It occurs in absence of any external force
- ( ) there is no passage of time during such displacement
- ( ) none of the above is true

19.   17. How many degrees of freedom does a particle have that is constrained   1 point
to move on sphere? *

Mark only one oval.

- ( ) 0
- ( ) 1
- ( ) 2
- ( ) 3

20.   18. Constraint in a rigid body is *   1 point

Mark only one oval.

- ( ) Holonomic
- ( ) Non-holonomics
- ( ) Rheonomic
- ( ) None of these

21.   19. A rigid body moving freely in space has degrees of freedom *   1 point

Mark only one oval.

- ( ) 3
- ( ) 6
- ( ) 9
- ( ) 4

22.   20. Degree of freedom in Dumbbell moving in space is *   1 point

Mark only one oval.

- ( ) 2
- ( ) 3
- ( ) 4
- ( ) 5

23.   21. As the wavelength of the radiation decreases, the intensity of the black   1 point
      body radiations _____ *

      Mark only one oval.

      ◯ Increases

      ◯ Decreases

      ◯ First increases then decrease

      ◯ First decreases then increase

24.   22. If wavelength for which the maximum energy emitted by black body is   1 point
      6590Å, the temperature of black body is.... *

      Mark only one oval.

      ◯ 4400 K

      ◯ 440K

      ◯ 44K

      ◯ 4.4K

25.   23. An experiment shows that when electromagnetic radiation of   1 point
      wavelength 270nm falls on an aluminum surface, photoelectrons are
      emitted. The most energetic of these are stopped by a potential
      difference of 0.406 volts. What is the work function of aluminum in
      electron volts *

      Mark only one oval.

      ◯ 5.7 eV

      ◯ 2.2 eV

      ◯ 4.2 eV

      ◯ 10.3 eV

26.   24. Which one of the following pairs of phenomena illustrates the particle   1 point
       aspect of wave particle duality? *

Mark only one oval.

◯ Compton effect and Bragg's law

◯ Photoelectric effect and Compton effect

◯ Compton effect and Pauli's principle

◯ Bragg's law and Photoelectric effect

27.   25. During Einstein's Photoelectric Experiment, what changes are   1 point
       observed when the frequency of the incident radiation is increased? *

Mark only one oval.

◯ The value of saturation current increases

◯ No effect

◯ The value of stopping potential increases

◯ The value of stopping potential decreases

28.   26. From the figure, what's the relation between T1, T2, and T3? *   1 point
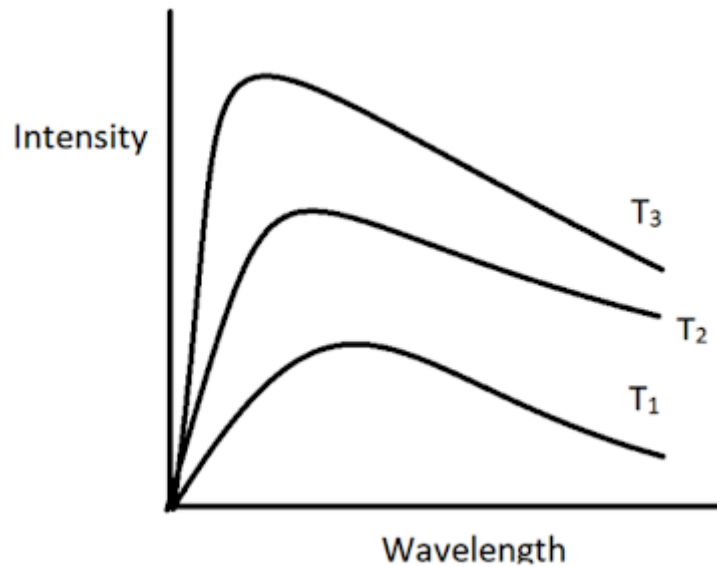
Mark only one oval.

( ) T1 > T2 > T3

( ) T3 > T2 > T1

( ) T3 > T1 > T2

( ) T2 > T1 > T3

29.   27. The wavelength for which energy is maximum is *   1 point

Mark only one oval.

( ) directly proportional to the absolute temperature

( ) inversely proportional to absolute temperature

( ) unchanged with temperature

( ) cannot be predicted

30.   28. The number of oscillation modes per unit volume for em standing waves of frequency v in a blackbody cavity is proportional to *

1 point

Mark only one oval.

○ v³

○ v²

○ v

○ hv/(exp[hv/kT]-1)

31.   29. The unit of absorptive power is... *

1 point

Mark only one oval.

○ T

○ Ts⁻¹

○ Ts

○ no unit

32.   30. In a photoelectric effect experiment, the frequency of the light is increased while keeping the intensity of the light constant. What effect does this have? *

1 point

Mark only one oval.

○ fewer electrons will be ejected

○ more electrons will be ejected

○ the same number of electrons will be ejected

○ any of these is possible

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