Royal College of Arts, Science & Commerce
Sample Paper
T.Y.B.Sc.
Semester VI
Physics Paper IV (USPH604)
Relativity

Q.1 Select correct answer

1. According to Galilean transformation which basic quality is not independent of relative motion of the observer
(a) Length (b) Mass (c) Time (d) Temperature

2. The optical device used in the Michelson-Morley experiment was ……..
(a) Telescope (b) Grating (c) Interferometer (d) prism

3. A space-ship is travelling at a speed of 0.8c. The contraction of length observed as a fraction of it's proper length is……..
(a) 0.4 cm (b) 0.4 (c) 0.2 (d) 0.4 m

4. That velocity of light is same no matter which inertial frame a observer is in, is the
(a) Principle of Relativity (b) Principle of Simultaneity
(c Principle of Constancy (d) Principle of Time Dilation

5. An elementary particle by the name muon is formed by cosmic rays high up in the atmosphere. What is the lifetime of muon as observed by us if it travels with a speed of 0.99 c for a distance of 5.4Km.
(a) 18.18 X 10^{-5} sec (b) 1818 sec (c) 1.818 X 10^{-5} sec (d) 1.818 sec

6. Two particles approach each other with a speed 0.8 c with respect to the laboratory. Their relative speed is _____
(a) 0.912 c (b) 0.95 c (c) 0.975 c (d) 0.85 c

7. If λ is actual wavelength of light emitted by receding star, then observed wavelength λ′ is given by
(a) $\frac{\lambda}{\sqrt{1-\beta^2}}$ (b) $\lambda\sqrt{1-\beta^2}$ (c) $\lambda\sqrt{\frac{1-\beta}{1+\beta}}$ (d) $\lambda\sqrt{\frac{1+\beta}{1-\beta}}$

8. A photon has velocity c in an inertial frame s' moving with velocity v , then its velocity as observed from system s will be …..
(a) c+v (b) c- v (c) **c**
(d) c+v if both velocities are along same direction and c- v if they are in opposite direction

9. If the sun radiates energy at the rate of 4 x 10^{26} Js^{-1}, what is the rate at which its mass is decreasing?
(a) 5.54 x 10^9 kgs^{-1} (b) 4.44 x 10^9 kgs^{-1} (c) 3.44 x 10^9 kgs^{-1} (d) 2.44 x 10^9 kgs^{-1}

10. The space time diagram is also called as_____
(a) Minkowski diagram (b) Lorentz diagram (c) Maxwell diagram (d) Real diagram

11. For Pair Production phenomenon to occur to photon must have energy, greater than or equal to _____

(a) 0.51 MeV (b) 1.02 MeV (c) 0.32 MeV (d) 0.85 MeV

12. What will be the rest energy of an electron?

(a) 0.41 MeV (b) 0.51 MeV (c) 0.61 MeV (d) 0.71 MeV

13. Two grams of helium are completely converted into energy and used to power a 100kg man. If all of this energy is converted into kinetic energy of the man, how fast will he move?

(a) $v \approx 109.5 m/s$ (b) $v \approx 2450 m/s$ (c) $v \approx 6\times10^5 m/s$ (d) $v \approx 1.90\times10^6 m/s$

14. The relativistic relation between energy and momentum

(a) $E_k = \frac{1}{2}(m_0 u^2)$ (b) $E^2 = p^2c^2 + m_0^2c^4$ (c) $E_k = \frac{1}{2}(m u^2)$ (d) $E^2 = p_0^2c^2 + m_0^2c^4$

15. A particle has rest mass m_o and is moving with velocity 0.6c.Determine it's Relativistic mass.

(a) $1.25m_0$ (b) $12.5m_o$ (c) $1.35m_o$ (d) $13.5m_o$

16. The law of conservation of charge says that the outflow of current per unit volume must equal the

(a) positive rate of increase of charge density
(b) negative rate of increase of charge density
(c) negative rate of decrease of charge density
(d) positive rate of constant charge density

17. If the charge q is invariant then the electric flux over a surface enclosing the charge

(a) vary with the factor β
(b) depends upon the frame of references
(c) must be Non-invariant
(d) must be invariant

18. ---------- component of electric field and ---------- component of magnetic field are unaltered in Lorentz transformation.

(a) parallel, parallel
(b) parallel, perpendicular
(c) perpendicular, parallel
(d) perpendicular, perpendicular

19. If only electric field exists in steady frame of reference then there can be -------- in moving frame of reference.

(a) only electric field (b) only magnetic field
(c) both electric and magnetic field (d) no electric and magnetic field

20 A cube having rest length (l_0) and number of electrons (N) inside it moves with velocity (u) along positive x-axis then the correct relation between charge density in moving frame (ρ_s) and rest frame ($\rho_{s'}$) is ----------

(a)$\rho_s = \rho_{s'}$ (b)$\rho_s > \rho_{s'}$ (c)$\rho_{s'} = 0$ (d)$\rho_s < \rho_{s'}$