
2021-12-22

1. When a light wave goes from air into water, the quality that remains unchanged is its

Speed

Amplitude

Frequency

Wavelength

2. Galileo writes that for angles of projection of a projectile at angles $(45+\theta)$ and $(45-\theta)$, the horizontal ranges described by the projectile are in the ratio of (if $\theta \leq 45$)

2 : 1

1 : 2

1 : 1

2 : 3

3. A thick plane mirror shows a number of images of the filament of an electric bulb. Of these, the brightest image is the

First

Second

Fourth

Last

4. Absolute refractive indices of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$. The ratio of velocity of light in glass and water will be

4 : 3

8 : 7

8 : 9

3 : 4

5. A narrow tunnel is made through the earth of mass M and radius R from the centre to the surface. The speed (in m/s) with which a particle should be projected from the centre of the earth through the tunnel so that it escapes to the space is

$\sqrt{2gR}$

\sqrt{gR}

$$\sqrt{3gR}$$

$$2\sqrt{gR}$$

6. Three charges are placed at the vertices of an equilateral triangle of side a as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is

$$Q^2 / (4\pi\epsilon_0 a^2)$$

$$-Q^2 / (4\pi\epsilon_0 a^2)$$

$$Q^2 / (2\pi\epsilon_0 a^2)$$

Zero

7. An object of mass $3m$ splits into three equal fragments. Two fragments have velocities $v\hat{j}$ and $v\hat{i}$. The velocity of the third fragment is

$$v(\hat{j} - \hat{i})$$

$$v(\hat{i} - \hat{j})$$

$$-v(\hat{i} + \hat{j})$$

$$\frac{v(\hat{i} + \hat{j})}{\sqrt{2}}$$

8. A photosensitive metallic surface has work function $h\nu_0$. If photons of energy $2h\nu_0$ fall on this surface the electrons come out with a maximum velocity of $4 \times 10^6 \text{ m/s}$. When the photon energy is increased to $5h\nu_0$ then maximum velocity of photo electron will be

$$2 \times 10^6 \text{ m/s}$$

$$2 \times 10^7 \text{ m/s}$$

$$8 \times 10^5 \text{ m/s}$$

$$8 \times 10^6 \text{ m/s}$$

9. 540 g of ice at 0°C is mixed with 540 g of water at 80°C . The final temperature of the mixture is

0°C

40°C

80°C

Less than 0°C

10. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is ($\alpha_{Cu} = 1.7 \times 10^{-5} \text{ K}^{-1}$ and $\alpha_{Al} = 2.2 \times 10^{-5} \text{ K}^{-1}$)

56 cm

68 cm

74 cm

88 cm

11.The coefficient of performance of a Carnot refrigerator working between $30^{\circ}C$ and $0^{\circ}C$ is

10

1

9

0

12.The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

6.25%

20%

26.8%

12.5%

13.The range of $f(x) = \cos(x/3)$ is

$(-1/3, 1/3)$

$[-1, 1]$

$(1/3, -1/3)$

$(-3, 3)$

14.The value of the determinant $\begin{vmatrix} 4 & -6 & 1 \\ -1 & -1 & 1 \\ -4 & 11 & -1 \end{vmatrix}$ is

-75

25

0

-25

15.The general solution of the equation $\sin(\theta) = \sin(\alpha)$ where $0 \leq \alpha \leq 2\pi$ is:

$\theta = n\pi \pm \alpha$

$$\theta = n\pi + (-1)^n \alpha$$

$$\theta = 2n\pi + \alpha$$

$$\theta = 2n\pi - \alpha$$

16.If θ be the angle between two vectors a and b, then $a.b \geq 0$ if

$$0 \leq \theta \leq \pi$$

$$\frac{\pi}{2} \leq \theta \leq \pi$$

$$0 \leq \theta \leq \frac{\pi}{2}$$

None of these

17.The coefficient of largest term in the expansion of $(1+x)^5$ is:

120

20

60

10

18.The image of $(-2, 1)$ when reflected about the line $y = x$ is:

$(1, -2)$

$(-1, 2)$

$(2, -1)$

$(2, 1)$

19.If $A \cap B = B$, then

$$A \subset B$$

$$B \subset A$$

$$A = \phi$$

$$B = \phi$$

20.

$$\frac{d}{dx} \left[\tan^{-1} \left(\frac{a-x}{1+ax} \right) \right] =$$

$$-\frac{1}{1+x^2}$$

$$\frac{1}{1+a^2} - \frac{1}{1+x^2}$$

$$\frac{1}{1 + \left(\frac{a-x}{1+ax} \right)^2}$$

$$\frac{-1}{\sqrt{1 - \left(\frac{a-x}{1+ax} \right)^2}}$$

21. The number of bacteria cell in a lab is modelled by a function of time $N = N_0(1 - ke^{-\lambda t})$ where $0 < k < 1$ and N_0 is a positive integer. When the number of cells is just half of the maximum, what is rate of growth?

$$-\frac{N_0\lambda}{2}$$

$$\frac{N_0\lambda}{3}$$

$$N_0\lambda$$

$$\frac{N_0\lambda}{2}$$

22. Real part of $e^{\exp(i\theta)}$ is

$$e^{\cos \theta} [\cos(\sin \theta)]$$

$$e^{\cos \theta} [\cos(\cos \theta)]$$

$$e^{\sin \theta} [\sin(\cos \theta)]$$

$$e^{\sin \theta} [\sin(\sin \theta)]$$

23. For $0 \leq x \leq \pi$ the area bounded by $y = x$ and $y = x + \sin x$, is

$$2$$

$$4$$

$$2\pi$$

$$4\pi$$

24. If the equation $ax^2 + 2hxy + by^2 = 0$ represents two lines $y = m_1x$ and $y = m_2x$, then

$$m_1 + m_2 = \frac{-2h}{b} \text{ and } m_1 m_2 = \frac{a}{b}$$

$$m_1 + m_2 = \frac{2h}{b} \text{ and } m_1 m_2 = \frac{-a}{b}$$

$$m_1 + m_2 = \frac{2h}{b} \text{ and } m_1 m_2 = \frac{a}{b}$$

$$m_1 + m_2 = \frac{2h}{b} \text{ and } m_1 m_2 = -ab$$

$$25. \lim_{n \rightarrow \infty} \frac{1^p + 2^p + 3^p + \dots + n^p}{n^{p+1}} \text{ is}$$

$$\frac{1}{p+1}$$

$$\frac{1}{1-p}$$

$$\frac{1}{p} - \frac{1}{p-1}$$

$$\frac{1}{p+2}$$

26. The straight lines I_1, I_2, I_3 are parallel and lie in the same plane. A total number of m points are taken on I_1 , n points on I_2 , k points on I_3 . The maximum number of triangles formed with vertices at these points are

$${}^{m+n+k}C_3$$

$${}^{m+n+k}C_3 - {}^m C_3 - {}^n C_3 - {}^k C_3$$

$${}^m C_3 + {}^n C_3 + {}^k C_3$$

None of these

27. The equation of the normal to the circle $x^2 + y^2 = 1$ at the point $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ is

$$x + y = 0$$

$$x - y = \frac{\sqrt{2}}{3}$$

$$x - y = 0$$

none of these

28. A parabola passing through the point $(-4, -2)$ has its vertex at the origin and y-axis as its axis. The latus rectum of the parabola is :

6

8

10

12

29. Nitrogen dioxide

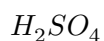
Dissolves in water forming nitric acid

Does not dissolve in water

Dissolves in water to form nitrous acid and gives off oxygen

Dissolves in water to form a mixture of nitrous and nitric acid

30. Which of the following behaves as both oxidising and reducing agents?



31. The number of molecules of CO_2 present in 44 g of CO_2 is

6.0×10^{23}

3×10^{23}

12×10^{23}

3×10^{10}

32. Percentage of silver in German silver is:

10%

2%

1%

0%

33. 100 cm^3 of 0.1 N HCl solution is mixed with 100 cm^3 of 0.2 N $NaOH$ solution. The resulting solution is

0.1 N basic

0.05 N basic

0.1 N acidic

0.05 N acidic

34. When cold NaOH reacts with Cl_2 which of the following is formed ?

NaClO

NaClO_2

NaClO_3

None of these

35. The pK_a of a weak acid is 4.8. What should be the ratio of $[\text{Acid}]/[\text{Salt}]$ of a buffer if $pH = 5.8$ is required

10

0.1

1

2

36. The IUPAC name of the following organic compound is :

2,4-dichloro 4-formylbut-2-en-3-ol

2,4-dichloro-1-formylbut-3-en-3-ol

2,4-dichloro-3-hydroxypent-3-enal

2,4-dichloro-3-hydroxypent-2-en-4-al

37. The concert _____ at 7 O'clock in the evening next Friday.

starts

started

had started

is starting

38. Choose the correct one:

"He is", she said; "an honest man."

"He is", she said, "An honest man."

"He is," she said, "An honest man."

"He is," she said, "an honest man."

39. The manager ordered that the workers _____ on time.

is

was

be

were

40. Hunting tigers are dangerous. The word 'hunting' in the above sentence is a:

gerund

participle

verb

adverb