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CBSE Board
Class XI Physics
Sample Paper – 5

Q1. The e. m. f. E of a certain thermocouple depends on the temperature difference θ between its two junctions in accordance with the relation E = 70θ - $\frac{\theta^2}{20}$, where E is in microvolt, θ in degree Celsius and one junction is at zero degree Celsius. If E may be determined to be ± 100 μV, the possible error in °C, when measuring a temperature of 200°C is

(A) ± 1.4
(B) ± 1.7
(C) ± 2.0
(D) ± 5.0

Sol. (c)

$$E = 70\theta - \frac{\theta^2}{20}; \frac{dE}{d\theta} = 70 - \frac{2\theta}{20}$$

$$\text{Here, } dE = \pm 100\mu V, \theta = 200^\circ C$$

$$\therefore d\theta = \pm \frac{100}{50} = \pm 2.0$$

Q2. The curie is a unit used for the measurement of

(a) Radioactivity
(b) Magnetism
(c) electric field
(d) temperature

Sol. (a)

1 curie of radioactivity corresponds to 3.7×10^{10} disintegrations per second

Q3. The question contains statement-1 (Assertion) and Statement-2 (Reason), each question has four choices. You have to select the correct choice.

Assertion: The magnitude of average velocity is the same as the average speed.
Reason: The magnitude of instantaneous velocity is the magnitude of instantaneous speed.

(a) if statement-1 is true but statement-2 is false
(b) if staternent-1 is false and statement-2 is true
(c) if both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1
(d) if both statement-1 and statement-2 are true but statement-2 is not the correct explanation of staternent-1

Sol. (b)

For a particle going in a circle and completing a circle, average velocity is zero whereas average speed is not zero.

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Q4. From a building two balls A and B are thrown such that A is thrown upwards and B downwards (both vertically). If vA and vB are their respective velocities on reaching the ground, then
(a) $UB > UAB$
(b) $UA = UBC$
(c) $UA > UB$
(d) Their velocity depends on their masses.

Sol. (b)
Ball A projected upwards with velocity u falls back to building top with velocity u downwards. It completed its journey to ground under gravity.
$\therefore \ V_A^2 = u^2 + 2gh$ ...(i)
Ball B starts with downwards velocity u and reaches ground after travelling a vertical distance h
$\therefore \quad V_B^2 = u^2 + 2gh$ ...(ii)
From (i) and (ii) , $V_A = V_B$

Q5. In a harbour, wind is blowing at the speed of 72 kmph and the flag on the mast of a boat anchored in the harbour flutters along the N-E direction. If the boat starts moving at a speed of 51 km/h to the north, what is the direction of the flag on the mast of the boat?
(a) East
(b) 37° north of east
(c) 37° south of east
(d) south-west

Sol. (a)
$\bar{V}_w = Velocity\ of\ wind = 72\ Km/m$
$\bar{V}_B = Volocity\ of\ baot = 51\ km/h$
The flag will flutter in the direction of velocity of wind with respect to the boast or
$VWB = VW = V_B\ ; 72 \cos 450 \ = 51$
Thus, it is evident that vwB is towards east.

Q6. The apparent weight of a person of mass m in an elevator is 2mg. The elevator is moving
(a) up with an acceleration of $\frac{g}{2}$
(b) up with an acceleration of g
(c) up with an acceleration of 2g
(d) down with an acceleration g

Sol. (b)
Apparent weight is the normal force N experiment by the person.
$N - mg = ma; N = m\ (g - = +a)$
$Here\ \ N = 2mg$
$\Rightarrow \quad 2mg = mg + ma$
$or \ \ a = g$

Q7. The question contains statement-1(Assertion) and Statement-2(Reason), the question has four choices. You have to select the correct choice.
Assertion: Rolling friction is due to deformation at the point of contact.
Reason: Due to deformation, the total contact force on the wheel doesn't remain perpendicular to the surface of contact and thus has a component along horizontal.

(a) if statement-1 is true but statement-2 is fuse
(b) if statemnt-1 is false and statement.2 is true
(c) if both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1
(d) if both statement-1 andstatement-2 are true but statement2 is not the correct explanation of statement-1

Sol. (c)
Assertion is true, Reason is true and Reason is a correct explanation for Assertion.

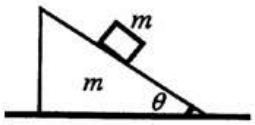
Q8. If mass-energy equivalence is taken into account, when water is cooled to form ice, the mass of water should
(a) increase
(b) remain unchanged
(c) decrease
(d) first increase then decrease.

Sol. (c)

Q9. A car of mass 1000 kg moving with a speed of 18 km/h on a smooth road collides with a horizontally mounted spring of spring constant $6.25 \times 10^3\ Nm^{-1}$. The maximum compression of the spring is
(a) 0.5 cm
(b) 0.8 cm
(c) 1.6 cm
(d) 2.0 cm

Sol. (d)

Q10. A block of mass m slides down an inclined wedge of same mass m shown in figure. Friction is absent everywhere. Acceleration of centre of mass of the block and wedge is



(a) Zero
(b) $\frac{gsin^2\theta}{(1+\sin^2\theta)}$
(c) $\frac{g\cos^2\theta}{(1+\sin^2\theta)}$
(d) $\frac{g\sin\theta}{(1+cos\theta)}$

Sol. (b)
Let a be the acceleratt on of wedge leftwards and a, be the relative accelerati on of block down the plane.
$a, Cos\theta - a = a \Rightarrow 2a = a, Cos\ \theta$ .... (1)

For wedge, N sin θ = ma …… (2)
For bock, perpendicular to plane
$N + m\sin\theta = mg\ Cos\ \theta$ ….(3)
From eqs. (1), (2) and (3), we get,
$a_\theta = \frac{2g\ sin}{1+\sin^2\theta}$

Acceleration on of block vertically downwards.
$a_y = a_r\ \sin\theta = \frac{2\ g\sin^2\theta}{1+Sin^2\theta}$
Acceleration on of COM is
$a_\theta = \frac{a_y}{2} = \frac{g\ Sin^2}{1+\sin^2\theta}$

Q11. If two particles of masses 3kg and 6kg which are at rest are separated by a distance of 15m. The two particles are moving towards each other under a mutual force of attraction. Then the ratio of stances travelled by the particles before collision is
(a) 2 : 1
(b) 1 : 2
(c) 1 : 3
(d) 3 : 1

Sol. (a)
Distance travelled = Distance from centre of mass $m_1x = m^2\ (15-x)$

Q12. The question contains statement-1 (Assertion) and Statement-2 (Reason). It has four choices. You have to select the correct choice.
Assertion: A planet moves faster, when it is closer to the sun in its orbit and vice versa.
Reason: Orbital velocity in orbit of planet is constant.
(a) if statement-1 is true but statement 2 is false.
(b) if statement-1 is false and statement-2 is true.
(c) if both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1.
(d) if both statement-1 and statement-2 are true but statement-2 is not the correct explanation of statement-1.

Sol. (a)
According to Kepler's law of planetary motion, a planet revolves around the sun in such a way that it's areal velocity is constant. i.e., it moves faster, when it is closer the sun and vice-versa.

Q13. The escape velocity of a body from the surface of Earth is 11.2 km s^{-1}.If a body is projected in a direction making an angle of 45° to the vertical, then the escape velocity is
(a) 11.2 kms^{-1}
(b) 11.2 sin 45° km s^{-1}
(c) 11.2 cos 45° km s^{-1}
(d) $\frac{11.2}{\sqrt{2}}\ km\ s^{-1}$

Sol. (a)
Escape velocity is independent of direction of projection.

Q14. A projectile can have same range R for two angles of projection. If T_1 and T_2 be the time of flights in the two cases, then the product of the two time of flights is directly proportional to
(a) $1/R^2$
(b) $1/R$
(c) R
(d) R^2

Sol. (b)

Q15. The wings of an aeroplane are designed such that
(a) the pressure on the upper surface of the wings in greater than the pressure on the lower surf ace
(b) the velocity of air current on the upper surface is more than that on the lower surface
(c) the velocity of air current on the upper surface is less than that on the lower surface
(d) the lower surface is convex

Sol. (b)

Q16. If there were no atmosphere, the earth would have been
(a) Very cold
(b) Very hot
(c) Slightly cold
(d) Slightly hot

Sol. (a)

Q17. A metal rod has a length of 1 m at a temperature of 283 K and a length of 1.2 m at a temperature of 383 K. The coefficient of linear expansion of the material is
(a) 0.2 /k
(b) 0.02/k
(c) 0.002 /k
(d) 0.0002 /k

Sol. (c)

$$\alpha = \frac{\mathbf{l}_2 - \mathbf{l}_1}{\mathbf{l}_1(\theta_2 - \theta_1)} = \frac{0.2}{1(100)} = 0.002/K.$$

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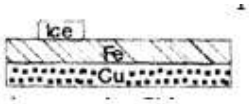
Q18. A cube of ice is placed on a bimetallic strip at room temperature as shown in the figure. What will happen if the upper strip of iron and the lower strip is of copper?



(a) Ice moves downward
(b) Ice moves upward
(c) Ice remains in rest
(d) None of the above

Sol. (a)
When ice cube is place at the composite strip, temperature of the strip decreases. Due to this strip bend downward. Hence, ice cube moves uppers

Q19. If coeffiecnt of real expansion of a liquid is 1/5500 % C. The temperature which its density is 1% less than density at 0°C is
(a) 55.5°C
(b) 100°C
(c) 99°C
(d) 1°C

Sol. (a)
$\frac{d_0}{d_1} = 1 + y_r t$

Q20. A specific gravity bottle contains of masses 21 gms and 20 gms at 50°C and 100°C respectively. The coefficient of apparent expansion of liquid is
(a) $10 \times 10^{-4}/°C$
(b) $10^{-4}/°C$
(c) $10^{-5}/°C$
(d) $10^{-6}/°C$

Sol. (a)
$y_a = \frac{x}{(m-x)\Delta t}$

Q21. A ring shaped piece of a metals heated, If the material expands, the hole will
(a) Contract
(b) Expand
(c) Remain same
(d) Expand or Contract depending on the width

Sol. (b)

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Q22. Always platinum is fused into glass, because
(a) Platinum is good conductor of heat
(b) Melting point of platinum is very high
(c) They have equal specific heats
(d) Their coefficients of linear expansion are equal

Sol. (d)

Q23. Two tuning forks A and B vibrating simultaneously produces 5 beats. Frequency of B is 512. It is seen that if one arm of A is filed then the number of beats increases, frequency of A will be (in Hz)
(a) 502
(b) 507
(c) 517
(d) 522

Sol. (c)

Q24. On a winter day, sound travels with velocity 336m/s. If velocity at 0ºC is 332 m/s, the atmospheric temperature is
(a) 7°C
(b) 10°C
(c) -7°C
(d) 8°

Sol. (a)

$$v_t = 332 + 0.6\theta \Rightarrow 336 = 332 + 0.6\theta \Rightarrow \theta = \frac{40}{6} = 6.6 \approx 7^{o}C.$$

Q25. Two sounds produces intensity of 1μW/m². $Iv\ \tau\epsilon\mu\sigma\ 0\phi\ y_1ß\epsilon y_1ß\epsilon\lambda\ \sigma\ \tau\eta\epsilon\ \lambda\ \sigma\ \tau\ o\ 0\ \phi\ 1v\tau\epsilon v\sigma 1\epsilon\sigma 1\sigma$
(a) 2 : 1
(b) 1 : 2
(c) 1 : 100
(d) 1000 : 1

Sol. (a)

$$\text{Intensity in dB} \Rightarrow N = 10\log\frac{I}{I_o}$$

$$\text{I case}: N_1 = 10\log\left(\frac{10^{-6}}{10^{-12}}\right) = 10\ \log\ 10^6 \Rightarrow N_1 = 60$$

$$\text{IIcase}: N_2 = 10\log\left(\frac{10^{-3}\times 10^{-9}}{10^{-12}}\right) = 10\ \log\ 10^3 \Rightarrow N_2 = 30$$

$$N_1 : N_2 :: 60 : 30 = 2 : 1$$

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Q26. If two tuning forks A and B are sounded together, they produce 4 beats / s. A is then slightly loaded with wax, they produce 2 beats when sounded again. The frequency of A is 256 Hz. The frequency of B will be

(a) 252
(b) 260
(c) 262
(d) 250

Sol. (a)

Q27. If the height of a capillary is smaller than the height to which water should rise, then

(a) water starts flowing out like a fountain
(b) water stops gets depressed in the capillary below the water surface
(c) water rises up to the height of the capillary and meniscus becomes less concave.
(d) water does not rise in such a capillary at all.

Sol. (c)

$S = \frac{h\rho gr}{2\cos\alpha}$

If h is not sufficient, then α changes after h takes on the value of the length of the tube.

Q28. Three liquids A,B and C of masses 400gm, 600 gm and 800 gm are at 30°c, 40°c and 50°c respectively. When A and B are mixed resultant temperature is 36°C when B and C are mixed resultant temperature is 44°C Then ratio of their specific heats are

(a) 2: 2 : 1
(b) 3 : 2 : 1
(c) 2 : 2 : 1
(d) 1 : 4 : 9

Sol. (a)

Q29. 50g of copper is heated to increase its temperature by 10°C. If the same quantity of heat is given to 10g of water, the rise in its temperature is (Specific heat of copper = 420J/kg/°C Specific heat of water 4200J/kg/°C

(a) 5°C
(b) 6°C
(c) 7°C
(d) 8°C

Sol. (c)

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Q30. A convex lens of focal length f is placed somewhere in between an object and a screen. The distance between the object and the screen is x. If the numerical value of the magnification product by the lens is m, the focal length of the lens is

(a) $\frac{mx}{(m+1)^2}$

(b) $\frac{mx}{(m-1)^2}$

(c) $\frac{(m+1)^2}{m}x$

(d) $\frac{(m-1)^2}{m}\ x$

Sol. (a)

$$\because x = u + v \qquad \ldots\ldots (i)$$

$$m = \frac{f}{(f+u)} = \frac{(f-v)}{f} \text{ For real image, m is negative}$$

$$\therefore -m = \frac{f}{(f+u)} \; or \; -mf - mu = f$$

$$or \; u = \frac{-(m+1)}{m} f$$

$$and \; -m = \frac{(f-v)}{f} \; or \; -mf = f - v$$

$$or \; v = (m+1)f \therefore x = (m+1)f + \frac{(m+1)}{m} f$$

$$or \; f = \frac{mx}{(m+1)^2}$$