NEW STANDARD ACADEMY

Test Type : Unit Test # 03 **11-11-24**

Do not open this Test Booklet until you are asked to do so.

JEE(MAIN): 12th Undergoing/Pass Students

Read carefully the Instructions on the Back Cover of this Test Booklet.

Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The Test Booklet consists of 90 questions.
4. There are three parts in the question paper 1,2,3 consisting of Physics, Chemistry and Mathematics having 30 questions in each subject and each subject having Two sections. (i) Section-I contains 20 multiple choice questions with only one correct option. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases. (ii) Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases.
5. Use Blue/Black Ball Point Pen only for writting particulars/marking responses on Side –1 and Side–2 of the Answer Sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/ Hall. However, the candidate are allowed to take away this Test Booklet with them.

Name of the Candidate(In Capitals) _____

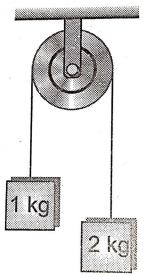
Date of Examintation _____

Candidate`s Signature:_____ Invigilator`s Signature: _____

PHYSICS

SECTION-1

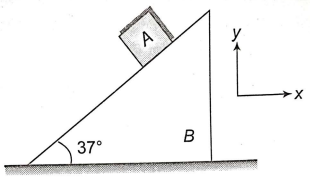
1. Two unequal masses are connected on two sides of a light string passing over a light and smooth pulley as shown in the figure. The system is released from rest. The larger mass is stopped 1.0 second after the system is set into motion and then released immediately. The time elapsed before the string is tight again is (Take g = 10 m/s²)



(a) 1/4 s
(c) 2/3 s
(b) 1/2 s
(d) 1/3 s

2. A plumb bob is hung from the ceiling of a train compartment. The train moves on an inclined track of inclination 30° with horizontal. Acceleration of train up the plane is a = g/2. The angle which the string supporting the bob makes with normal to the ceiling in equilibrium is
(a) 30°
(b) $\tan^{-1}(2/3)$
(c) $\tan^{-1}(\sqrt{3}/2)$
(d) $\tan^{-1}(2)$

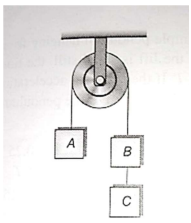
3. In the figure shown the acceleration of A is $\vec{a}_A = 15\hat{i} + 15\hat{j}$, then the acceleration of B is (A remains in contact 6 with B)



(a) $6\hat{i}$
(b) $-15\,\hat{i}$
(c) $-10\hat{i}$
(d) $-5\hat{i}$

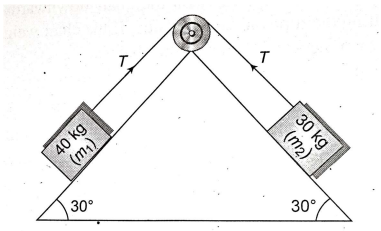
4. A cork is submerged in water by a spring attached to the bottom of a pail. When the pail is kept in an elevator moving with an acceleration downwards, the spring length
(a) increases
(b) decreases
(c) remains unchanged
(d) data insufficient

5. Three equal weights A, B and C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in the figure The tension in the string connecting weights B



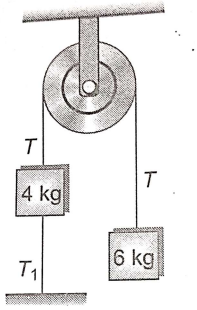
and C is
(a) Zero (b) 13N
(c) 3.3N (d) 19.6 N

6. Two masses 40 kg and 30 kg are connected by a weightless string passing over a frictionless pulley as shown in the following figure. The tension in the string will be



(a) 188N (b) 900/7N
(c) 288N (d) 1200/7N

7. Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is attached the table top by another string. The tension in this string T_1 is equal to (Take g = 10m / s^2)



(a) 20 N
(b) 25 N
(c) 10.6 N
(d) 10 N

8. Taking the radius of earth to be 6400 km, by what percentage will the acceleration due to gravity at a height of 100 km from the surface of earth differ from that on the surface of earth?
(a) About 1.5%
(b) About 5%
(c) About 8%
(d) About 3%

9. What is the minimum energy required to launch a satellite of mass ***m*** from the surface

of a planet of mass **M** and radius **R** in a circular orbit at an altitude of **2R** ?

(a) GmM/3R

(b) 5GmM/6R

(c) $\frac{2}{3}\frac{(GmM)}{R}$

(d) $\frac{(GmM)}{2R}$

10. The magnitudes of gravitational field at distances $\mathbf{r_1}$ and $\mathbf{r_2}$ from the centre of a uniform sphere of radius **R** and mass **M** are $\mathbf{I_1}$ and $\mathbf{l_2}$ respectively. Find the ratio ($\mathbf{I_1}$ / $\mathbf{I_2}$) if $\mathbf{r_1 > R}$ and $\mathbf{r_2 < R}$

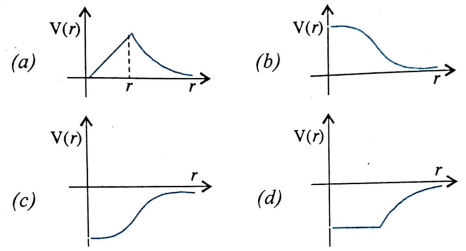
(a) $(R^2 / r_1 r_2$

(b) $R^3 / r_1 r_2^2$

(c) $(R^3) / r_1^2 r_2$

(d) $(R^4 / (r_1^2 r_2^2)$

11. Which of the following most closely depicts the correct variation of the gravitational potential **V(r)** due to a large planet of radius **R** and uniform mass density? (figures are not drawn to scale)



12. A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth **R; h <<R**) The minimum increase in its orbital velocity required, so that the satellite could escape from the earth's gravitational field, is close to: (Neglect the effect of atmosphere)

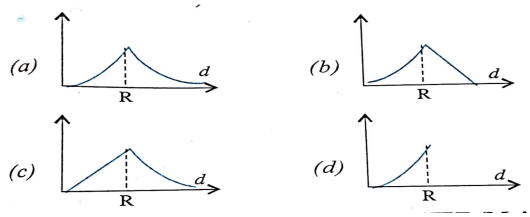
(a) $\sqrt{(2gR)}$

(b) $\sqrt{(gR)}$

(c) $\sqrt{(gR\ /\ 2)}$

(d)$\sqrt{(gR)}$ ($\sqrt{2}$ - 1)

13. The variation of acceleration due to gravity g with distance d from the centre of the earth is best represented by (R = Earth's radius)



14. The depth ***d*** at which the value of acceleration due to gravity becomes $\frac{\mathbf{1}}{\boldsymbol{n}}$ **times** its value at the **earth's surface** is **(R = radius of earth)**

(a) d = R(n/(n - 1))

(b) d = R((n - 1)/(2n))

(c) d = R((n - 1)/n)

(d) $d = R^2 ((n - 1)/n)$

15. A block placed on a horizontal surface is being pushed by a force F making an angle θ with the vertical. The coefficient of friction between block and surface is μ. The force required to slide the block with uniform velocity on the floor is

(a) μmg /(sin-cosθ)

(b) (sinθ-ucose θ) /μmg

(c) μmg

(d) none of these

16. A body of 5 kg weight kept on a rough inclined plane of angle 30º starts sliding with a constant velocity. Then the coefficient of friction is (assume g = 10m / s^2)

(a) 1 / $\sqrt{3}$ (b) 2 / $\sqrt{3}$

(c) $\sqrt{3}$ (d) $2\sqrt{3}$

17. A cylinder of 10 kg is sliding in a plane with an initial velocity of 10 m/s. If the coefficient of friction between the surface and cylinder is 0.5 then before stopping, it will cover. (g = 10m / s^2

(a) 2.5 m (b) 5 m

(c) 7.5 m (d) 10 m

18. A body takes just twice the time as long to slide down a plane inclined at 30° to the horizontal as if the plane were frictionless. The coefficient of friction between the body and the plane is

(a)$\frac{3}{4}$ (b) $\sqrt{(3)}$

(c) 4/3 (d) 3/4

19. A motorcycle is travelling on a curved track of radius 500 m. If the coefficient of friction between road and tyres is 0.5, the speed avoiding skidding will be

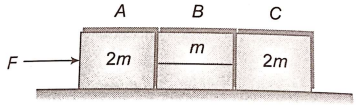
(a) 50 m/s

(b) 75 m/s

(c) 25 m/s

(d) 35 m/s

20. The system is pushed by a force F as shown in the figure. All surfaces are smooth except between B and C. Friction coefficient between B and C is Minimum value of F to prevent block B from down ward slipping is:



(a) (3/(2μ) mg (b) (5/(2 μ) mg

(c) (5/2) μ mg (d) (3/2) μ mg

SECTION-B

21. An asteroid is moving directly towards the centre of earth. When at a distance of **10 R (R** is the radius of the earth) from the earth's centre, it has a speed of **12 km/s**. Neglecting the effect of earth's atmosphere, what will be the speed of the asteroid when it hits the surface of the earth (escape velocity from the earth is **11.2 km/s**)? Give your answer to the **nearest integer in km/s……**

22. If the **acceleration due to gravity** experienced by a point mass at ***height h above the surface*** of earth ***is same*** as that of **the acceleration due to gravity at a depth αh (h <<R e)** from the **earth surface**, the value of α will be (Use R_e = 6400km)…….

23. On the horizontal surface of a truck (μ= 0.6), a block of mass 1 kg is placed. If the truck is accelerating at the rate of 5 m/sec² then find the frictional force on the block.

24. A body of 5 kg weight kept on a rough inclined plane of angle 30º starts sliding with a constant velocity. Then find the coefficient of friction (assume g = 10 m/s²)

25. A body of mass 10 kg is lying on a rough plane inclined at an angle of 30° to the horizontal and the coefficient of friction is 0.5. Find the minimum force required to pull the body up the plane.

CHEMISTRY

SECTION-I :

This section contains 20 questions. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) Only one option is correct. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. Which among the following molecules have sp d hybridisation with one lone pair of electron on the central atom?
   SF_4, PCl^+_4 , XeO_2F_2, SOF_4
   (A) SF_4, PCl^+_4 , XeO_2F_2,
   (B) SF_4, XeO_2F_2, SOF_4
   (C) SOF_4, XeO_2F_2,
   (D) XeO_2F_2, SOF_4

2. Two elements X and Y have following electronic configuration :
   X : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
   Y : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
   The expected compound formed by combination of X and Y will be expressed as :- (A) XY_2 (B) $X_5\ Y_2$
   (C) $X_2\ Y_5$ (D) XY_5

3. The incorrect order of bond dissociation energy will be:-
   (A) H–H > Cl – Cl > Br – Br
   (B) Si – Si > P – P > Cl – Cl
   (C) C – C > N – N > O – O
   (D) H – Cl > H – Br > H – l

4. In which of the following process breaking of covalent bond take place ?
   (A) Melting of ice
   (B) Melting of KCN
   (C) Melting of diamond
   (D) Boiling of liquid ammonia

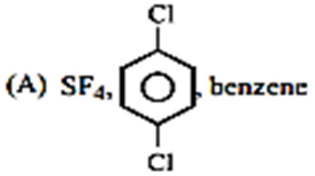
5. Which of the following order of volatility is correct?
   (A) HF > HCl > HBr > HI
   (B) H_2 O > NH > HF
   (C) CH_3 OH > CH –O–CH
   (D) p-nitrophenol < O-nitrophenol

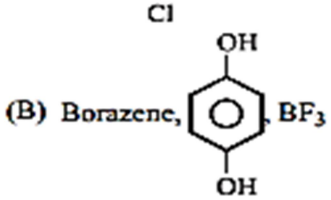
6. Which of the following molecular orbital has two nodal planes ?
   (A) σ_{2s} (B) π_{2py}
   (C) π^*_{2py} (D) σ^*_{2px}

7. Whichof the following wouldresult inthe formation of strongest π-bondif the molecularaxis isx-axis?
   (A) $2p_x + 2p_x$ (B) $2p_y + 2p_y$
   (C) $2p_y + 3d_{xy}$ (D) $2p_z + 4p_z$

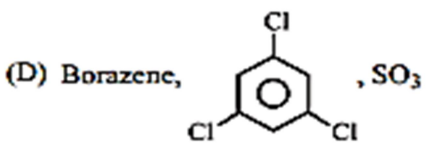
8. An element (X) forms compounds of the formula XCl_3 , $X_2\ O_5$ and $Ca_3\ X_2$ but does not form XCl_5 . Which of the following is the element(X) ?
   (A) B (B) Al
   (C) N (D) P

9. Which of the following is the correct order for increasing bond angle ?
   (A) $NH_3 < PH_3 < AsH_3 < SbH_3$





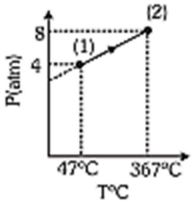
(C) ClF_3, SiF_4, SO_3



(B) $H_2O < OF_2 < Cl_2O$
(C) $H_3Te^+ < H_3Se^+ < H_3S^+ < H_3O^+$
(D) $BF_3 < BCl_3 < BBr_3 < BI_3$

10. Which set contain molecules with $\mu = 0$:

11. 2 moles of an ideal diatomic gas is subjected to the following process. Mark the correct option(s). [Given : R = 2 Cal/mol K]



(A) w = 0 (B) q = 4480 Cal
(C) ΔH = 2240 Cal (D) ΔE = 1600 Cal

12. Enthalpy change (ΔH) for the reaction $C_2H_5OH(\ell) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(\ell)$ at 27°C is –1366.5 kJ mol^{-1} . The value of internal energy change for the above reaction at this temperature will be
(A) –1371.5 kJ (B) –1369.0 kJ
(C) –1364.0 kJ (D) –1361.5 kJ

13. The heat capacity of liquid water is 75.6 J/K-mol. While the enthalpy of fusion of ice is 6.0 kJ/mol. What is the smallest number of ice cubes at 0°C, each containing 9.0 g of water, needed to cool 500g of liquid water from 20°C to 0°C ?
(A) 1 (B) 7
(C) 14 (D) 21

14. For adiabatic free expansion of ideal gas correct option will be :-
(A) $q = 0, \Delta T \neq 0, w = 0$
(B) $q \neq 0, \Delta T = 0, w = 0$
(C) $q = 0, \Delta T = 0, w = 0$
(D) $q = 0, \Delta T < 0, w < 0$

15. Calculate $\Delta_f H^\circ$ (in kJ/mol) for Cr_2O_3 from the $\Delta_r G^\circ$ and the S° values provided at 27°C
$4Cr(s)+3O_2(g) \rightarrow 2Cr_2O_3(s)$;
$\Delta_r G^\circ = -2093.4$ kJ/mol S° (J/K mol) :
$S^\circ(Cr, s) = 24$; $S^\circ(O_2, g) = 205$;
$S^\circ(Cr_2O_3, s) = 81$
(A) –2258.1 kJ/mol
(B) –1129.05 kJ/mol
(C) – 964.35 kJ/mol
(D) None of these

16. In conversion of lime-stone of lime,
$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
the values of ΔH° and ΔS° are +179.1 kJ mol^{-1} and 160.2 J K^{-1} respectively at 298 K and 1 bar. Assuming that ΔH° and ΔS° do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is :
(A) 1008 K (B) 1200 K
(C) 845 K (D) 1118 K

17. Oxygen gas weighing 64 gm is expanded from 1 atm to 0.25 atm at 30ºC. Calculate entropy change, assuming the gas to be ideal :-
(A) 11.04 cal mol^{-1} K^{-1}
(B) 22.02 cal mol^{-1} K^{1}
(C) 15.24 cal mol^{-1} K^{-1}
(D) 5.52 cal mol^{-1} K^{-1}

18. 18 gm glucose is completely combusted in bomb calorimeter, of heat capacity 1400 kJ/K, temperature changes from 27°C to 27.2 °C. Find magnitude of standard enthalpy of combustion of glucose in kJ/mol. [R = 8.314 J/mol-K]
(A) 1200 (B) 2000
(C) 2800 (D) 1400

19. The enthalpy of neutralization of a weak monoprotic acid (HA) in 1 M solution with a strong base is –55.95 kJ/mol. If the unionized acid is required 1.4 kJ/mol heat for it's complete ionization and enthalpy of neutralization of the strong monobasic acid with a strong monoacidic base is –57.3kJ/mol. What is the % ionization of the weak acid in molar solution ?
(A) 1% (B) 3.57%
(C) 35.7% (D) 10%

20. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio of C_p/C_v for the gas is
(A) 3/2 (B) 7/5
(C) 5/3 (D) 4/3

SECTION-II :(Maximum Marks: 20)

Full Marks :	+4 If correct answer is entered.
Zero Marks :	0 If the question is unanswered.
Negative Marks :	–1 If wrong answer is entered.

21. Number of 109°28' angles in CH_4 = x Number of 90° angles in SF_6 = y Number of 180° angles in XeF_4 = z Determine : (y – x– z)

22. How many of these molecules are non-polar ? O_3 , SO_3 , PCl_5 , CCl_4 , SF_4 , H_2O, PH_3 , PCl_3F_2 , XeF_4

23. Number of lone pair at iodine in ICl_3 is equal to x and number of lone pair at Xe in XeF_4 is equal to y, find $\left(\frac{x+y}{2}\right)$

24. How many of the following ionic compound will have lattice energy less than AlF . LiF, NaCl, $AlCl_3$, Na_2 O, NaBr, KCl, LiI, $BeCl_2$, MgF_2 .
25. What is the final temperature (in kelvin) of 0.10 mole monoatomic ideal gas that performs 75 cal of work adiabatically if the initial temperature is 227ºC ? (use R = 2cal/K-mol)

MATHS
SECTION-B

1. If a<0 the function (e^{ax}+e^{-ax}) is a monotonic decreasing function for all values of x, Where
   (a) x>0 (b) x<0
   (c) x>1 (d) x< 1
2. The range of values of values of a for which the function $f(x)= x^3+(a+2)x^2+3ax+5$ may be monotonic in R is
   (a) a<1 (b) 1< a<4
   © a>4 (d) None of these
3. If the function $f(x)=3cos|x|-6ax+b$ *increases for all* $x\in R$ then the range of values of a is given by
   (a) a> $-\frac{1}{2}$ (b) a < $-\frac{1}{2}$
   (c) $a\leq b$ (d) $a \geq b$
4. A function *f* is such that f'(a) = f ''(a)=f'''(a)=… = $f^{(2n)}$(a) =0 and f has a local maximum value b at x= a, if F(x) is
   (a) $(x-a)^{2n+2}$ (b) b-1-$(x+1-a)^{2n-1}$
   (c) b-$(x-a)^{2n+2}$ (d) $(x-a)^{2n+2}$-b
5. Let the function f(x) be defined as
   f(x)=$\begin{cases} tan^{-1}\alpha - 3x^2, 0 < x < 1 \\ -6x \qquad\quad x \geq 1 \end{cases}$
   f(x)can have a maximum at x=1 if the value of α *is*
   (a) 0 (b) 2
   (c) 1 (d) None of these
6. The function f(x) = $\frac{|x+1|}{x^2}$ is strictly decreasing in the interval
   (a) $(-\infty,-2)\cup(0,1)$
   (b) (-2,0) $\cup$ $(1,\infty)$
   (c) $(-2,-1)\cup(0,\infty)$
   (d) None of these
7. If the function f(x) =$2x^3$-$9ax^2$+$12a^2$x+1, where a>0, attains its maximum and minimum at p and q respectively such that p^2=q, then a equals
   (a) 3 (b)1
   (c) 2 (d) $\frac{1}{2}$
8. Let f be differentiable for all x. If f(1)= -2 and $f'(x) \geq 2$for x$\in$ $[1,6], then$
   (a) f(6)$\geq$ 8
   (b)f(6)<8
   (c) f(6)<5
   (d) f(6) =5
9. A spherical iron ball 10 cm in radius is coated with a layer of ice of uniform thickness than melts at a rate of 50 cm^3/min . When the thickness of ice is 5cm, then the rate at which the thickness of ice decreases is
   (a) $\frac{1}{36\pi} cm/min$
   $(b)\frac{1}{18\pi} cm/min$
   $(c)\ \frac{1}{54\pi} cm/min$
   $(d)\frac{5}{6\pi} cm/min$
10. If the function f and g are differentiable functions on [0,1] satisfying f(0)=2=g(1),g(0) = 0 and f(1) =6 then for some c$\in$]0,1[
    (a)2f '(c)=g'(c)
    (b) 2f '(c)= 3g'(c)
    (c) f '(c)=g'(c)
    (d) f '(c)=2g'(c)
11. The solution set f '(x)>g'(x) where f(x) = (1/2)5^{2x+1} and g(x)=5^x+4xlog5 is
    (a) $(1,\infty)$ (b) (0,1)
    (c) (0,∞) (d) [0,∞)
12. If $\sqrt{x+y}+\sqrt{x-y}$ =c then $\frac{d^2y}{dx^2}$ *equals*
    (a) $\frac{2}{c^2}$ (b) $\frac{-2}{c^2}$
    (c) $\frac{2}{c}$ (d) - $\frac{2}{c}$
13. If *f(x) =x, then the value of* $f(1)-\frac{f'(1)}{1!}+\frac{f''(1)}{2!}-\frac{f'''(1)}{3!}+\cdots+\frac{(-1)^n f^n(1)}{n!}$ *is*
    (a)2 (b) 2^{n-1}
    (c) 0 (d)1
14. Supposef(x)is differentiable x=1 and $\lim_{h\to 0}\frac{1}{h}f(1+h)=5, then\ f'(1) equal$
    (a)3 (b) 4
    (c) 5 (d) 6
15. The set of points where f(x) =$\frac{x}{1+|x|}$ is differentiable is
    (a) $(-\infty,0)\cup(0,\infty)$
    (b) $(-\infty,-1)\cup(-1,\infty)$
    (c) $(-\infty,\infty)$
    (d) $(0,\infty)$
16. Prove that tan $\frac{\pi}{10}$ is a root of polynomial equation $5x^4$-$10x^2$+1=0
    (a) 0 (b) 2
    (c) 5 (d) 7
17. If A, B,C are the angle of a triangle such that cot $\frac{A}{2}$ = 3 tan $\frac{C}{2}$, then sin A,SinB ,sin C are in

(a) A.P (b) G.P

(c) H.P (d) none of these

18. If $\sin x + \cos x = \frac{\sqrt{7}}{2}$, where $x \in \left(0, \frac{\pi}{4}\right), then\ \tan\frac{x}{2} is$ equal to

(a) $\frac{3-\sqrt{7}}{3}$ (b) $\frac{\sqrt{7}-2}{3}$

(c) $\frac{4-\sqrt{7}}{4}$ (d) None of these

19. Let P(x) = $\left(\frac{1-cos2x+si}{1+cos2x+sin2x}\right)^2 + \left(\frac{1+cotx+cot^2x}{1+ta\ \ x+tan^2x}\right)$ Then the minimum value of P(x) equals

(a) 1 (b)2 (c) 4 (d) 16

SECTION-B

20. In triangle ABC if angle C is 90^0 and the area of triangle is 30sq units then the minimum possible value of the hypotenuse c is equal to

(a) $30\sqrt{2}$ (b) $60\sqrt{2}$

(c) $120\sqrt{2}$ (d) $2\sqrt{30}$

21. The value of $\frac{sin1°+\sin 3°+sin5°+sin\ °}{cos1°.cos2°.sin4°}$ is _____

22. In a triangle ABC ,if A-B =120° and $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} = \frac{1}{32}$, then the value of 8 cosC is_____

23. If $\sin^3x \cos3x + \cos^3x \sin3x = 3/8$ then the value of sin4x is_____

24. The greatest value of $(x+2)^{\frac{1}{5}} - x^{\frac{1}{5}}$in [-1,0] is…….

25. Consider real function f(x) _____

$= \begin{cases} e^x - 2 - e^{-2}, x < -2 \\ x^2 - x + \lambda, -2 \le x \le 2 \end{cases}$ $If\ f\ (x)$has local maxima at x=-2 then minimum absolute value of λ is