A

Indian Association of Physics Teachers

NATIONAL STANDARD EXAMINATION IN Junior Science 2012-2013
Solution (Version A)

Total time: 120 minutes **Marks: 240**

Only one out of four options is correct

1) Solution: c
2) Solution: (a); Consider an observer on the truck. According to him truck is stationary. He will observe that ball goes up and lands in the boy's hand.

3) Solution: b;

4) Solution: (d); Pressure depends on the height of the water. Thus all at bottom of all the vessels are same.

5) Solution: b ; $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}>9$ *and therefore* $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}>6$ & $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}>8$ *is* always true

6) Solution : c

7) Solution: b

8) Solution: c
9) Solution: a

10) Solution: c

11) Solution: a

12) Solution: (b); As ball goes up the velocity reduces due to acceleration due to gravity. Thus acceleration is negative. It momentarily comes to rest at $t=\frac{v}{g}=\frac{20}{10}=2s$. After this ball accelerates in the downward direction. The velocity becomes more and more negative. Thus option *b* is correct option

13) Solution: a; Sixty Sixth Independence day 15/08/12 Wednesday. 2013 (67^{th}) is Thursday, 2014 (68^{th}) is Friday, 2015 (69^{th}) is Saturday, 2016 (70^{th}) is Monday, 2017(71^{th}) is Tuesday, 2018 (72^{nd}) is Wednesday.

14) Solution: (b); Speed of sound in water is greater than the speed in air. Thus water is an acoustically rarer medium compared to air. Therefore the refracted ray deviates away from normal. That is r>i.
15) Solution: d; $7^{2012} = (7^4)^{503} = (2401)^{503}$= ----------= 01; Remainder is 01.

16) Solution:c

17) Solution: a

18) Solution d
19) Solution: c

20) Solution: a
21) Solution: a

22) Solution: d

23) Solution: (a); Work done = Change in K.E; $w = \frac{1}{2}m(v_2^2 - v_1^2)$. The velocity $v_2=v_1+at$;

$v_2 = 2 + 2X9 = 20ms^{-1}$. Thus $w = \frac{1}{2}X0.5(20^2 - 2^2) = \frac{396}{4} = 99J$.

24) Solution: d ; $n^3-n = (n-1)(n)(n+1)$. If n=4998 then $(5000-2)^3$=125000000000-150000000+60000-8=124850059992. Therefore 4997X4998X4999=124850054994
25) Solution: (b); The reading in the spring balance is the tension in the spring. If you pulled the spring with 2N force on both the sides, then the tension is 2N. Even in the case of spring balance suspended from a rigid support and pulled by 2N force, the rigid support exerts force of 2N on it similar to above case.
26) Solution: c ; (ABXCD) +(ADXBC)=ACXBD ; (17X12)X(13X15)) + ((17X5)X(13X8))=ACX(13X17). Therefore AC = ((12X15)+(5X8)) = 180+40 = 220.

27) Solution: c

28) Solution: a

29) Solution: b
30) Solution: a
31) Solution: (a); *v-u* = 40 cm and v/u =3 Solving the two equations we have v= 20 cm and u= 60cm.

$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$; $\frac{-1}{20}-\frac{1}{60}=\frac{1}{f}$ $and\ f=-15cm$

32) Solution: c ; $\cot^2\theta$ (1-3secθ+2sec$^2\theta$) =1 (multiplying by $\sin^2\theta$).

$\cos^2\theta(1-\frac{3}{\cos\theta}+\frac{2}{\cos^2\theta}) = \sin^2\theta$; $\cos^2\theta$-3cosθ+2=1-cos$^2\theta$.

Therefore (cosθ-1)(cosθ-2)=(1-cosθ)(1+cosθ); 2cosθ=1; $\theta=60^0$ or $\theta= -60^0$.
Thus θ=360-60 = 300^0

33) Solution: (d); The purpose of the spectacle is to make the person see objects very far away (at ∞) though with his own ability can see up to a distance *d*. That is object at ∞ should produce the image at distance *d* due to spectacles. $\frac{1}{f}=\frac{1}{d}-\frac{1}{\infty};\frac{1}{-1/1.25}=\frac{1}{d}$. That is *d=-0.8m or 80cm*.

34) Solution: a;

35) Solution: b

36) Solution: c

37) Solution: a

38) Solution: d

39) Solution: (c); Same mass of same wire implies same volume. $A_1 l = A_2 (2l)$; $A_1=2A_2$; The ratio of resistance = $\frac{R_S}{R_l}=\frac{\rho l/A_1}{\rho 2l/A_2}=\frac{1}{4}$

40) Solution: c

$x^2+xy+xz=x(x+y+z)=135=27X5$; Therefore x=5

$y^2+yz+yx=y(x+y+z)=351=27x13$; Therefore y=13

$z^2+zx+zy=z(x+y+z)=243=27X9=$ Therefore z=9

$x^2+y^2+z^2=25+169+81=275$

41) Solution: (a); $P=I^2R$; $P' = (I+0.2I)^2 (R+0.2R) = 1.2^2X1.2(I^2R)=1.728$ P; Thus $\frac{\Delta P}{P}=0.728$

42) Solution: b; The base of the number system is 7; $(363)_7$ = 3X49 + 6X7 +3 = $(192)_{10}$

$(1056)_7$=1X343 + 5X7+6 =$(384)_{10}$; $(1452)_7$ = 1X343 + 4X49 + 5X7 + 2 = $(576)_{10}$

$(654)_7$ = 333; $(456)_7$ = 237; $(165)_7$ = 96

43) Solution: a

44) Solution: d

45) Solution: c

46) Solution: d

47) Solution: (d); When two magnets are combined the pole strength increases and hence the Magnetic field doubles. The number of field lines is proportional to Magnetic field thus it should be double.

48) Solution: d; AB=30; BC=(BM+MC)=18+18=36, AC=30

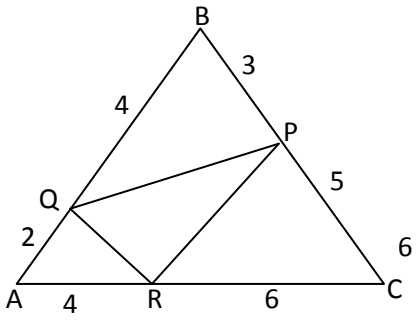
AM = (BMXMC)/MD = $\sqrt{AB^2-BM^2}$

Therefore $\sqrt{900-324}=\sqrt{576}=24=AM$. Thus MD=18X18/24 = 13.75.

Diameter of the circle = 37.5 and radius = 18.75

49) Solution:(b); Using thumb rule, the magnetic field due to segment AB, BC and CD is all in the same direction out off the plane of the paper.

50) Solution: c; A(ΔPQR) = A(ΔBQR)+A(ΔBPR)-A(ΔBPQ)
A(ΔBPQ) = ½ X4X3=6 (angle B =90^0)
A(ΔBQR) = 4/15 X A(ΔABC) = 6.4
A(ΔBPR) = 9/40 XA(ΔABC) = 5.4
A(ΔABC) = ½ X6X8 = 24 (angle ABC = 90^0) ; A(ΔPQR) = 6.4 + 5.4 - =5.8



51) Solution: d
52) Solution: c
53) Solution: a
54) Solution: (c); $\Delta mC^2 = E; \quad \Delta mX(3X10^8)^2 = 200X10^6X1.6X10^{-19}J$. The mass getting converted is given by, Δm = 3.55X10^{-28}Kg.

55) Solution: a ; $a^2 = (\sin(x) + \sin(y))^2$; $b^2 = (\cos(x)-\cos(y))^2$ and $2 = \sin^2x + \sin^2y + \cos^2x + \cos^2y$
$2-a^2-b^2 = 2(\cos(x)\cos(y)-\sin(x)\sin(y)) = 2\cos(x+y)$

56) Solution: (c); The equation for displacement along the horizontal direction and vertical direction are, *x=(ucosθ)t and y =(usinθ)t – (1/2)gt²* and Thus $y = (\tan\theta)x - \frac{g}{2(u\cos\theta)^2}x^2$ or *y=ax-bx²*.
This implies the path is parabolic

57) Solution: d ; Height of the trapezium = diameter of the circle; AD=BC= 5+15=20; BP=15-5=10; PC=10√3. The radius is 5√3 area of circle = πr².

58) Solution: d
59) Solution: a
60) Solution: d
61) Solution: (a); Heat required to melt 60g of ice is Q_{ice}=60X80=4800 cal. The heat given out by 20 g of water when cooled from 40^0C to 0^0C is Q_{water}=40X20X1=800cal. Since Q_{water} is less than Q_{ice}, entire ice will not melt. Thus the final temperature will be 0^0C.
62) Solution: a ; $y = \frac{1}{x}$; Let y=100 and x=4. Therefore K=xy=400. If x=5 (increased by 25%). Thus
$y = \frac{K}{x} = \frac{400}{5} = 80$

63) Solution: (b); From the definitions of wavelength

64) Solution: c; $\frac{2}{15}=(\frac{1}{3}-\frac{1}{5})$; $\frac{2}{35}=(\frac{1}{5}-\frac{1}{7})$; $\frac{2}{63}=(\frac{1}{7}-\frac{1}{9})$ ---------- $\frac{2}{9999}=(\frac{1}{99}-\frac{1}{101})$

$$\frac{2}{15}+\frac{2}{35}+\frac{2}{63}+-------\frac{2}{9999}=(\frac{1}{3}-\frac{1}{101})=\frac{101-3}{303}=\frac{98}{303}$$

65) Solution: d

66) Solution: c

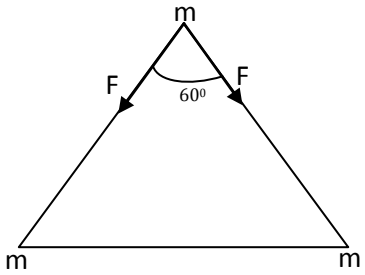
67) Solution: c

68) Solution: (d); For the power dissipation to be same, the effective resistance of parallel combination must be 10Ω. That is, $\frac{1}{10}=\frac{1}{R}+\frac{1}{100};R=\frac{100X10}{100-10}=11.11\Omega$

69) Solution: a; If roots are 1 and m then the quadratic equation is (x-1)(x-m)=0. Thus x^2-(m+1)x+m=0. p = (m+1) and q=m. Therefore p^2-2q = $(m+1)^2$-2m = m^2+1 and q=m.

70) Solution: (a); The resultant force on mass *m* is

$$F_R=\sqrt{F^2+F^2+2F^2(\cos 60)};F_R=\sqrt{3}F=\sqrt{3}\frac{Gm^2}{R^2}$$



71) Solution: b ; (1-a)(1-b)(1-c) = 1 – (a+b+c) + (ab + bc + ca) – abc;
[(a+b+c)^2 – (a^2+b^2+c^2)]/2 = ab + bc +ca = (1-21)/2 =-10 ;
(1-a) (1-b) (1-c) = 1 – (1) + (-10) – (8) = -18

72) Solution: c

73) Solution: b

74) Solution: b

75) Solution: (c);

76) Solution: a ; $\frac{75}{2x-x}+\frac{75}{2x+x}=16$; (time = distance/effective speed)

$\frac{75}{x}+\frac{25}{x}=16$; 16x=100 ; x=6.25 and 2x =12.5

77) Solution (b)

78) Solution: d; Slope of the line parallel to 4x+3y=5 is m = -4/3 . The point through which the line is passing (-3,0). Equation $(y-y_1)=m(x-x_1)$; $y-0=\frac{-4}{3}(x+3)=\frac{-4x-12}{3}$

4x+3y+12=0

79) Solution: b

80) Solution: d

Answer Keys

Version A							
Q no	Answer	Q no	Answer	Q no	Answer	Q no	Answer
1	C	21	A	41	a	61	a
2	A	22	D	42	b	62	a
3	B	23	A	43	a	63	b
4	D	24	D	44	d	64	c
5	B	25	B	45	c	65	d
6	C	26	C	46	d	66	c
7	B	27	C	47	d	67	c
8	C	28	A	48	d	68	d
9	A	29	B	49	b	69	a
10	C	30	A	50	c	70	a
11	A	31	A	51	d	71	b
12	B	32	C	52	c	72	c
13	A	33	D	53	a	73	b
14	B	34	A	54	c	74	b
15	D	35	B	55	a	75	c
16	C	36	C	56	c	76	a
17	A	37	A	57	d	77	b
18	D	38	D	58	d	78	d
19	C	39	C	59	a	79	b
20	A	40	C	60	d	80	d