JEE EXPERT

PRACTICE TEST – 05 (02 APRIL 2020)

ANSWER KEY & SOLUTION

PHYSICS

(PART– A)

1. c	2. b	3. d	4. b
5. b	6. b	7. d	8. c
9. ab	10. bc	11. acd	12. bc
13. a – q, b – p, c – r, d – r	14.	a – pqr, b – p, c – s, d – s	

(PART– C)

1. 9	2. 2	3. 6	4. 2
5. 5	6. 6		

CHEMISTRY

(PART– A)

1. b	2. a	3. a	4. c
5. b	6. c	7. d	8. a
9. acd	10. cd	11. ab	12. acd
13. a – pqt, b – pqrt, c – pqrt, d - pqs		14. a – r, b – q, c – p, d – s, t	

(PART– C)

1. 5	2. 9	3. 4	4. 1
5. 5	6. 1		

MATHEMATICS

(PART– A)

1. a	2. d	3. d	4. d
5. a	6. c	7. a	8. c
9. abcd	10. ab	11. abcd	12. cd
13. a – r, b – p, c – s, d – q	14.	a – q, b – pt, c – r, d – s	

(PART– C)

1. 3	2. 2	3. 3	4. 1
5. 2		6. 4	

SOLUTION
PHYSICS

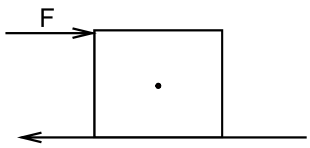
1. C

$\frac{1}{2}mv^2+\frac{1}{2}Iw^2=E_5=\frac{3}{4}mv^2$

$E_p=\frac{1}{2}m(2v)^2=2mv^2$

$\frac{E_p}{E_s}=8:3$

2. C



$FL=mg\frac{1}{2}$

F = $\frac{mg}{2}$

3. D

$F=\pi r^2\left[pg(h+l)\right]$

4. C

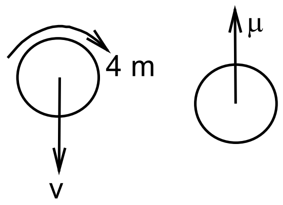
$e=\frac{2}{3}$

$4(\mu+v)m=J$

$\mu J=2mv\left(1+\frac{2}{3}\right)=\frac{10}{3}mv$

$\mu J.R=IW$

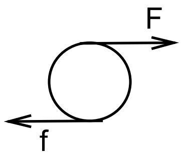
$W=40\,rad/s$



5. B

F – F = ma

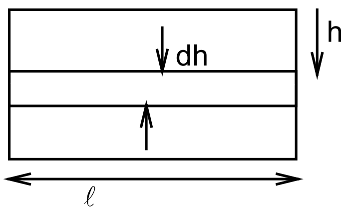
$F\frac{R}{2}+fR=I\alpha$



a = αR

$\therefore f=+ive$

6. B



$dp=\rho_o\left(1+\frac{h}{H}\right)gh$

$dF=\rho_o\left(1+\frac{h}{H}\right)ghldh$

$=\rho_o gl\left[hdh+\frac{h^2dh}{H}\right]$

$F=\rho_o gl\left[\frac{H^2}{2}+\frac{1}{3}H^2\right]$

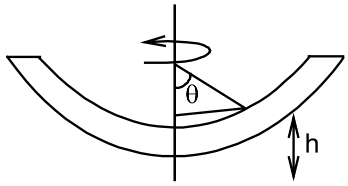
$=\frac{5}{6}H^2\rho_o gl$

$=\frac{5}{6}HA\rho_o g$

7. D

Now, $h=R(1-\cos\theta)$

$$mg\sin\theta = mw^2 R\sin\theta\cos\theta$$



$$mg = mw^2 R\left(1-\frac{h}{R}\right)$$

$$\frac{g}{w^2} = R-h$$

$$h = R-\frac{g}{w^2}$$

8. C

The C.M will not shift

9. AB

At A no K.E but at C rotational K.E Hence height h_A will be greater that height h_C

$\therefore$ $h_A > h_C$; $k_C > k_A$; $k_B > k_C$

10. BC

$$a = \frac{f}{M+m}$$

$$Kx = ma = \frac{mf}{M+m}$$

$$x = \frac{mf}{(M+m)K}$$

This x is the equilibrium extension. Maximum extension is = $2x = \frac{2mf}{(M+m)k}$

11. BC

$$R = \frac{r_1 r_2}{r_2 - r_1} = 0.004$$

Excess pressure sp is much in smaller sphere. The interface will be towards the larger sphere.

12. BC

$$210 - v\rho_w = 180$$

$$210 - v\rho_2 = 120$$

$$\therefore \rho_2 = 3$$

$$\rho_m =$$

13. a – q, b – p, c – r, d - r

Momentum is same. Then use conservation of energy

14. a – s, b – p, c – r, d – s

(a) s

x = vt

$$y = \frac{v}{w}$$

$\therefore y = c$ $\therefore$ st line

(b) p

x = vt

$$y = \frac{v}{w} = \frac{v}{\alpha t} = \frac{v^2}{\alpha x}$$

$$xy = \frac{v^2}{\alpha} = c$$

$\therefore$ rect. Hyperbola

(c) r

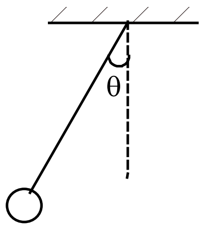
$$x=\frac{1}{2}at^2$$
$$y=\frac{v}{w}=\frac{a}{w}t$$
$$\therefore y^2=\frac{a^2}{w^2}.\frac{2x}{a}=\frac{2a}{w^2}x$$
$$y^2=kx$$
$\therefore$ parabola

(d) s

$$x=\frac{1}{2}at^2$$
$$y=\frac{v}{w}=\frac{a}{\alpha}=c$$
$\therefore$ st line

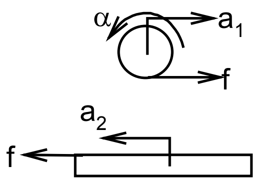
Integer Type

1. 4



$$T\sin\theta=mw^2r$$
$$T\cos\theta=mg \qquad r=\ell\sin\theta$$
$$T=mw^2\ell$$
$$w=\sqrt{\frac{T}{m\ell}}=\sqrt{\frac{324}{0.5\times0.5}}=\frac{18}{0.5}=36$$

2. 2



f = ma_1
f = μmg
a_1 = μg
a_2 = μg
$\therefore$ Reactive acc = $2\mu g$

3. 6

$$\frac{2mg\sin37^o}{k}=x=\frac{6mg}{5k}$$

4. 2

Suppose it leaves the surface with speed V & M moves with speed u.
Mu = mv

$$mgh=\frac{1}{2}mv^2+\frac{1}{2}m\frac{m^2v^2}{m^2}$$
$$v^2=\frac{2mgh}{m+\frac{m^2}{M}}=\frac{2gMh}{M+m}$$
mv = (M + m) v^1
$$h_{max}=\frac{\frac{1}{2}mv^2-\frac{1}{2}(M+m)(v^1)^2}{mg}$$
$$=\frac{v^2}{2}\left[\frac{m-\frac{m^2}{M+m}}{mg}\right] \qquad =\frac{v^2}{2g}\frac{M}{(M+m)} \qquad =\left(\frac{M}{M+m}\right)^2h$$

5. 5

Set at time t it happens
$$\therefore \vec{v}_1=3\hat{i}-gt\hat{j}$$

$\vec{v}_2 = -4\hat{i} - gt\hat{j}$

$\vec{v}_1.\vec{v}_2 = 0$

$\therefore 12 = g^2 t^2$

$t^2 = \frac{12}{100} = \frac{3}{25}$

$t = \frac{\sqrt{3}}{5}$

$x = (v_1 + v_2)t = 7.\frac{\sqrt{3}}{5}$

6. 6

$dF = \left[h(2\pi r dr)\frac{wr}{h}\right]2$

dP = dF. V

$= \frac{4h\pi}{h}(wr)^2 r\,dr$

$\int_o^P dP = \frac{4h\pi w^2}{h}\int_o^R r^3 dr = \frac{h\pi w^2 R^4}{h}$

r + y = 6

SOLUTION
CHEMISTRY

1. B

For reversible isothermal expansion of an ideal gas

$$w = -nRT\,\ln\frac{V_2}{V_1} = -nRT\ln\frac{10V_1}{V_1} = -nRT\ln 10 = -10KJ$$

$\therefore$ nRT = 4.34 kJ = 4.34 × 10^3 J

Again, P_1V_1 = nRT

10^7 Pa × V_1 = 4.34 × 10^3 J

$\therefore V_1$ = 0.434 × 10^{-3} m^3 = 0.434 litre

2. A

$$C_6H_6(l) + \frac{15}{2}O_2 \rightarrow 6CO_2 + 3H_2O\,q_v(l) = -800\,kcal\text{..........................}(1)$$

$$C_2H_2(g) + \frac{5}{2}O_2(g) \rightarrow 2CO_2(g) + H_2O\,q_v(l) = -310\,kcal\text{...................}(2)$$

3 × (2) – (1)

$$3C_2H_2(g) \rightarrow C_6H_6(l)\,q_v = 3x - 310 + 800 = -930 + 800 = -130\,kcal$$

$$q_p = q_v + \Delta nRT$$

= (- 130 + - 3 × 2 × 300 × 10^{-3}) kcal = - 131.8 kcal

3. A

$$2AgCl(s) \rightarrow 2Ag^{+}(aq) + 2Cl^{-}(aq) \quad K = \left(10^{-10}\right)^{2}$$

$$2AgBr(s) + 2Cl^{-}(aq) \rightarrow 2AgCl(s) + 2Br^{-}(aq) K = \left(\frac{1}{2\times10^{2}}\right)^{2}$$

$$2Br^{-} + Ag_2S(s) \rightarrow 2AgBr(s) + S^{-2}(aq) \; K = \frac{1}{1.6\times10^{24}}$$

$$Ag_2S(s) \rightarrow 2Ag^{+}(aq) + S^{-2}(aq) \qquad K = \frac{10^{-20}}{4\times10^{4}\times1.6\times10^{24}} = 1.56\times10^{-49} = K_{sp} \text{ of } Ag_2S$$

4. C

$Rate_{10\ min}$ = k $[Reactant]_{10min}$ = 0.04 mol/litre sec

$Rate_{20\ min}$ = k $[Reactant]_{20\ min}$ = 0.03 mol/litre sec

$$\frac{[Reactant]_{10min}}{[Reactant]_{20min}} = \frac{e^{-10k}}{e^{-20k}} = e^{10k} = \frac{4}{3}$$

$$\therefore k = 0.0287 \text{ min}^{-1}$$

$$t_{1/2} = \frac{0.693}{0.0287} = 24 \text{ min}$$

5. B

	$2HI(g) \rightleftharpoons$	$H_2(g)$	+ $I_2(g)$
Initial No. of moles	1	0	0
No. of moles at equilibrium	0.2	0.4	0.4 $(\because \alpha = 0.8)$

$$\therefore K_C = \frac{(0.4)^2}{(0.2)^2} = 4$$

	H_2	+ $I_2(g)$	$\rightleftharpoons 2HI(g)$
Initial No. of moles	2	2	0
No. of moles at equation	2 – x	2 – x	2x

$$\begin{array}{cccc} H_2 & + \; I_2(g) & \rightleftharpoons & 2HI(g) \\ 2 & 2 & & 0 \\ 2-x & 2-x & & 2x \end{array}$$

$\therefore \dfrac{4x^2}{(2-x)^2}=\dfrac{1}{4}$ or, $x = 0.4$

$\therefore$ No. of moles of I_2 left at equilibrium = 1.6

Number of moles $Na_2S_2O_3$ required to reduce I_2 = 3.2

$\therefore$ Volume of 2M $Na_2S_2O_3$ solution required = $\dfrac{3.2}{2}=1.6\,\text{lit}$

6. C

$P(V – b) = RT$

or, $\dfrac{P}{T}=\dfrac{R}{(V-b)}$

Plot of P vs T at constant V (isochore) will be $\left(\dfrac{R}{V-b}\right)$

7. D

$$\because\ mvr=\frac{nh}{2\pi} \Rightarrow v=\frac{nh}{2\pi mr} \Rightarrow \because\ KE=\tfrac{1}{2}mv^2=\frac{1}{2}m\left(\frac{nh}{2\pi mr}\right)^2$$

$$r=\frac{a_o\times h^2}{2} \Rightarrow r_3=\frac{a_o\times 3^2}{1}=9a_o \Rightarrow KE=\frac{1}{2}m\left(\frac{3^2h^2}{4\pi^2m^2(9a_o)^2}\right)$$

$$=\frac{1}{2}\cancel{m}\left(\frac{\cancel{9}h^2}{4\pi^2\cancel{m}^2\times\cancel{81}_9a_o^2}\right)=\frac{h^2}{72\pi^2ma_o^2}$$

8. A

Silicon carbide or Carborundum is obtained by reducing silica with carbon $SiO_2+3C\rightarrow SiC+2CO$

9. ACD

$\ln [A]_t = \ln [A]_0 – kt$ (for 1 st order reaction)

slope of $\ln [A]_t$ vs $t = k$

$k = 0.0231\ \sec^{-1}$

$$t_{1/2} = \frac{0.693}{0.0231} = 30\ \text{secs}$$

Half life is independent of initial concentration. So a plot of $t_{1/2}$ vs concentration will give a straight line parallel to x – axis.

$$t_{90\%} = \frac{1}{0.0231}\ln\frac{100}{10} = 100\ \text{secs}$$

At higher temperature, value of rate constant k increases. So, the slope of the plot $\ln[A]_t$ vs t will increase and the line will become steeper.

10. CD

11. AB

Addition of cis – diol and glycerol increases strength of boric acid by forming chelate and the reaction proceeds in forward reaction.

12. ACD

$\Delta S_{x\to z} = \Delta S_{x\to y} + \Delta S_{y\to z}$ (Enthalpy is a state function and hence additive)

$\Delta H_{x\to y\to z} = \Delta H_{x\to z}$ (State function, depend in initial and final state)

$W_{x\to y\to z} = W_{x\to y}$ (work done in $y \to z$ is zero as it is an isochoric process)

13. A - PQT

Both PCl_3F_2 & PCl_2F_3 have P with sp^3d hybridization, have trigonal bi pyramidal shape and zero formal charge on P.

B – PQRT

Both BF_3 & BCl_3 have B with sp^2 hybridization, have trigonal planar shape, zero dipole moment and zero formal charge on B.

C – PQRT

Both CO_2 & CS_2 have C with sp hybridization, have linear shape, zero dipole moment and zero formal charge in C.

D – PQS

Both C_6H_6 and $B_3N_3H_6$ have the central atom with sp^2 hybridization, have planar molecule and same number of electrons.

14. A – R

. $\Delta n = +ve,\ \Delta H > \Delta E$

B – Q

$\Delta n = 0,\ \Delta H = \Delta E \neq 0$

C – P

$\Delta n = -ve, \Delta H < \Delta E$

D – S, T

$q_p = 0 = \Delta H, q_v = 0 = \Delta E$

Integer Type

1. 5

$$P_{Total} = P_{HNO_3} + P_{NO_2} + P_{H_2O} + P_{O_2}$$

$$P_{NO_2} = 4P_{O_2} \quad P_{H_2O} = 2P_{O_2}$$

$$\therefore\ P_{Total} = P_{HNO_3} + 7P_{O_2}$$

$$\therefore 30 - 2 = 7P_{O_2}$$

$$\therefore P_{O_2} = 4\,atm, P_{H_2O} = 8\,atm,\ P_{NO_2} = 16\,atm, \qquad \therefore K_P = \frac{\left(P_{NO_2}\right)^4 \times \left(P_{H_2O}\right)^2 \times P_{O_2}}{\left(P_{HNO_3}\right)^4} = \frac{(16)^4 \times (8)^2 \times 4}{2^4} = 2$$

$$K_P = K_C\left(RT\right)^{\Delta n}$$

$$\therefore K_C = \frac{2^{20}}{\left(0.08 \times 400\right)^3} = 32 = 2^5$$

2. 9

Both equilibria are established simultaneously

$$X\left(s\right) \rightleftharpoons \underset{x}{A\left(g\right)} + \underset{(2x+2y)}{2B\left(g\right)} \qquad K_{P_1} = P_A.\left(P_B\right)^2 = x \times \left(2x + 2y\right)^2 = 7.2 \times 10^{-2}\ atm^3$$

$$Y\left(s\right) \rightleftharpoons \underset{y}{C\left(g\right)} + \underset{(2y+2x)}{2B\left(g\right)} \qquad K_{P_2} = P_c.\left(P_B\right)^2 = y \times \left(2y + 2x\right)^2 = 3.6 \times 10^{-2}\ atm^3$$

$$\frac{K_{P_1}}{K_{P_2}} = \frac{x}{y} = 2 \qquad \therefore x = 2y$$

$$K_{P_1} = x\left(2x + 2y\right)^2 = 7.2 \times 10^{-2}$$

x = 0.2 atm, y = 0.1 atm

Total pressure = $P_A + P_B + P_C = 3\,(x + y) = 0.9$ atm = 9×10^{-1} atm

$\therefore\ a = 9$

3. 4

Electronic configuration of Ar : $1s^2 2s^2 2p^6 3s^2 3p^6$ electrons (2 in one of the 2 p orbitals, 2 in one of the 3 p orbitals) will have $m_l = 1$

4. 1

Rate = k $[A]^x$ $[B]^y$

$6.93 \times 10^{-6} = k\,(0.01)^x (0.01)^y$ _____________ (1)

$1.386 \times 10^{-5} = k\,(0.02)^x\,(0.01)^y$ _____________ (2)

$1.386 \times 10^{-5} = k\,(0.02)^x\,(0.02)^y$ _____________ (3)

$(2)\div(1) \qquad 2^x = 2 \qquad \therefore x = 1$

$(3)\div(2) \qquad 2^y = 1 \qquad \therefore y = 0$

Overall order = x + y = 1 + 0 = 1

5. 5

$$3Br_2 + 3Na_2CO_3 \rightarrow 5NaBr + NaBrO_3 + 3CO_2$$

6. 1

pOH = 10

pH = 4 = - log $[H^+]$

Let, the basicity of the acid be n

Then concentration of $[H^+]$ in a 5×10^{-5} M solution of acid = $5 \times 10^{-5} \times n$

$-\log(5 \times 10^{-5} \times n) = 4$

n = 2

$\therefore$ 1 mole of this acid will neutralize 1 mole of a diacidic base.

SOLUTION
MATHEMATICS

1. A

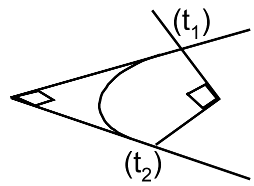
2. D

Product of roots = $a^2 < 0$

3. D

Using A.G.P the sum = $\dfrac{(2n-1).3^{n+1}+3}{4}$

4. D



$(y-2)^2 = 2(x+2)$

Let, $x + 2 = X$, $y - 2 = Y \Rightarrow Y^2 = 2X \Rightarrow a = \frac{1}{2}$

Angle between normals is $\frac{\pi}{2} \Rightarrow$ angles between the tangents is $\pi/2 \Rightarrow t_1t_2 = -1$. The point of intersection lies on directrix

$\Rightarrow x + 2 = -1/2 \Rightarrow 2x + 5 = 0$

5. A

$$\left(x+\frac{7}{2}\right)^2 = y + \frac{41}{4}$$

Let, $x + \frac{7}{2} = X$, $y + \frac{41}{4} = Y \Rightarrow X^2 = Y$, any pt. on the parabola (t, t^2) equation of the st –line

$$Y - \frac{41}{4} = 3\left(X - \frac{7}{2}\right) - 3 \Rightarrow 12X - 4Y - 13 = 0$$

$$-\left(\frac{dX}{dY}\right)\Bigg|_{(t^2,t)} = -\frac{1}{2t} = -1/3 \Rightarrow t = 3/2$$

$\therefore x = -2, y = -8$

6. C

$$\sum_{r=1}^{n}(r+1)\left(r+\frac{1}{w}\right)\left(r+\frac{1}{w^2}\right) = \sum(r+1)(r^2-r+1) = \sum_{r=1}^{n}(r^3+1) = \frac{n^2(n+1)^2+4n}{4}$$

7. A

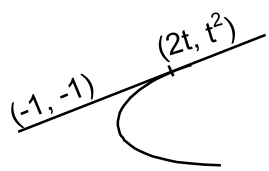
$$\left|\frac{z_1}{z_2}+i\right|^2 = \left|\frac{z_1}{z_2}-i\right|^2 \Rightarrow \frac{z_1}{z_2} - \frac{\bar{z}_1}{z_2} = 0 \Rightarrow \frac{z_1}{z_2} = \overline{\left(\frac{z_1}{z_2}\right)} \Rightarrow \frac{z_1}{z_2} \text{ is purely real.}$$

8. C

$$\frac{a+2.\frac{b}{2}+3.\frac{c}{3}}{1+2+3} \geq \left|a\left(\frac{b}{2}\right)^2\left(\frac{c}{3}\right)^3\right|^{\frac{1}{6}} \Rightarrow ab^2c^3 \leq 108$$

9. ABCD

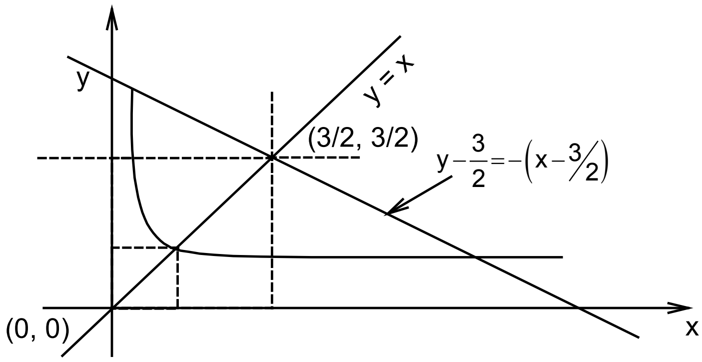
10. AB



Any pt. on the parabola $x^2 = 4y$ is $(2t, t^2)$, $\frac{dy}{dx}\Big|_{(2t,t^2)} = t$

$$\frac{t^2+1}{2t+1}=t \Rightarrow t=\frac{-1\pm\sqrt{5}}{2}$$

11. ABCD



12. CD

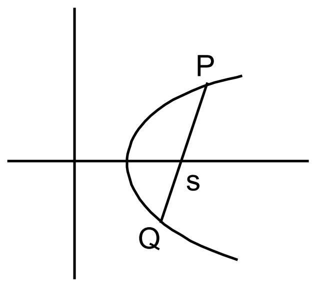
$$7\left(\frac{y}{x}\right)^2+2|k|\left(\frac{y}{x}\right)-4=0 \Rightarrow \frac{-2|K|}{7}=-\frac{4}{7}\Rightarrow K=-2,\ 2$$

13. a – r, b – p, c – s, d – q

(a) $1^2 - 2 \times 8 < 0$

(b)

$$\frac{2SP.SQ}{SP+SQ}=4 \Rightarrow \frac{6x}{6+x}=2 \Rightarrow x=3$$



(c) $y = tx - 2at - at^3$, $a = -2 \Rightarrow t = -2$, $-k = 4t + 2t^3 \Rightarrow k=24$

(d) q

14. a – q, b – pt, c – r, d - s

(a) $\frac{r}{1-r}=1\Rightarrow r=1/2$

(b) $(1-2)^n = 1$

(c) $1.\frac{(3^n-1)}{2}>1000$

(d) $\frac{3-r}{(1-r)^2}=\frac{44}{9} \Rightarrow r=\frac{1}{4}$

Integer type

1. 3

$a = \frac{1}{4} \Rightarrow am^3 + (2a - h)\, m + k = 0 \Rightarrow m_1 + m_2 + m_3 = 0 \Rightarrow m_1m_2 + m_2m_3 + m_3m_1 = \frac{2a-h}{a}$

$m_1m_2m_3 = \frac{-k}{a} \Rightarrow m_1m_2 = -1,\ m_3 = 0 \Rightarrow -1 = \frac{2a-h}{a} \Rightarrow c = \frac{3}{4} \Rightarrow 4c = 3$

2. 2

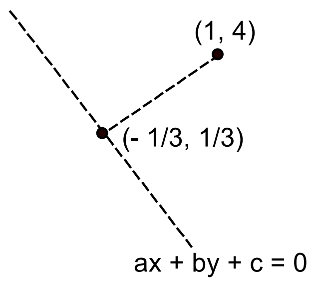
The algebraic sum of ordinates of the foot of three normals drawn to a parabola from a given point is zero.

3. 3

$(x+y)+\lambda(2x-y+1)=0 \Rightarrow x + y = 0,\ 2x - y + 1 = 0, \Rightarrow x = -1/3,\ y = 1/3$

Since line $ax + by + c = 0$ passes through point $\left(\frac{-1}{3}, \frac{1}{3}\right)$

$\therefore \frac{-a}{3} + \frac{b}{3} + c = 0 \Rightarrow -a + b + 3c = 0 \Rightarrow b - a = -3c \Rightarrow \left|\frac{b-a}{c}\right| = |-3| = 3$



4. 1

5. 2

6. 4