DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

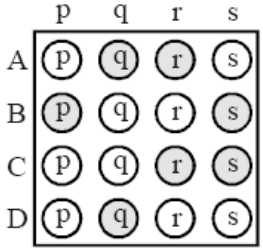
29.03.2009

Total time: 20 min

Matrix Match Type Questions

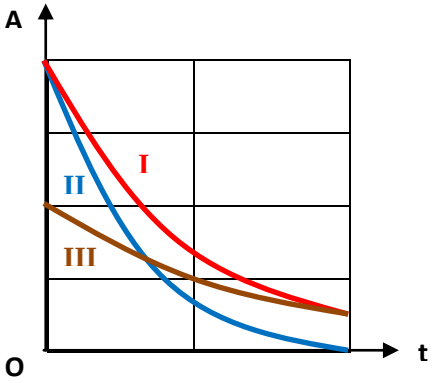
This section contains 3 questions. Each question contains statements given in two columns which have to be matched. Statements in **Column I** are labeled as A, B, C and D whereas statements in **Column II** are labeled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



Physics

Figure shows activities A of three different radioactive material's samples versus time. Using the given information correctly match the requisite parameter in the Column I with the options given in Column II.



	Column I		Column II
a	Disintegration constant has maximum value for the material of sample	p	I
b	Half life is maximum for the material of the sample	q	II
c	Initially if samples of all three materials have same number of atoms then number of parent atoms will be maximum after their respective two half-lives in the sample	r	III
d	Suppose all the materials decay by emitting a-particles of same energy and initially all three samples contain same amount (in gm) of the materials. Till the end of time span equal to their respective half lives, maximum energy is radiated by sample	s	Anyone out of these as it is not possible to compare

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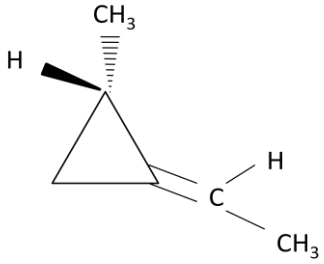
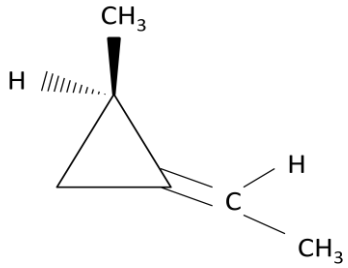
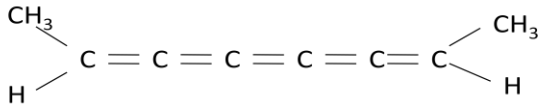
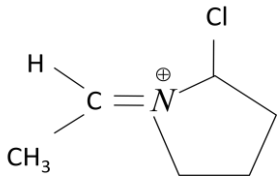
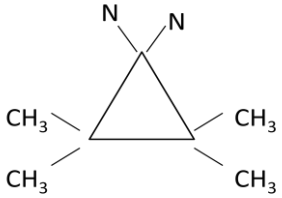
Chemistry

Match molecules of column I with their isomerism in column II.

	Column I		**Column II**
a	 and 	p	Geometrical isomer
b		q	Optical isomer
c		r	Not geometrical isomer
d		s	Not optical isomer

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Mathematics

Match column I with column II

	Column I		Column II
a	$\int\frac{e^{2x}-e^{x}}{e^{2x}+1}dx = A\ln(e^{2x}+1)+B\tan^{-1}(e^{x})+C$	p	$A=-\frac{1}{2},\quad B=-\frac{1}{4}$
b	$\int\frac{(x-x^3)^{1/3}}{x^4}dx = A\left(\frac{1}{x^2}-1\right)^{4/3}+Bx+C$	q	$A=-\frac{3}{8},\quad B=0$
c	$\int\frac{\cos 8x-\cos 7x}{1+2\cos 5x}dx = A\sin 2x+B\sin 3x+C$	r	$A=\frac{1}{2},\quad B=-1$
d	$\int\frac{\ln x}{x^3}dx = A\frac{\ln x}{x^2}+B\frac{1}{4x^2}+C$	s	$A=-\frac{1}{2},\quad B=\frac{1}{3}$

SOLUTION:

Physics

a → q; b → r; c → r; d → s

a) Activity of the sample II becomes half in minimum time. Hence it has maximum disintegration constant.
b) Activity of the sample III takes maximum life to become half therefore it has maximum half - life.
c) Parent nuclei will be left maximum in the sample, for which half life is maximum i.e. minimum decay.
d) It can not be compared without information about atomic weight as energy radiated will depend upon no. of atoms, not upon amount of substance.

Chemistry

a → q, r; b → p, s; c → p, q; d → r, s

Mathematics

a → r; b → q; c → s; d → r

(A) $\int \frac{e^{2x} - e^{x}}{(e^{2x}+1)} dx$

$\frac{1}{2}\int \frac{2e^{2x}dx}{e^{2x}+1} - 1\int \frac{e^{x}dx}{(e^{2x}+1)}$

$= \frac{1}{2}\log(e^{2x}+1) - \tan^{-1} e^{x} + C, A = \frac{1}{2}, B = -1$

(B) $\int \frac{\left(x - x^{3}\right)^{\frac{1}{3}}}{x^{4}} dx = \int \frac{\left(x^{-2} - 1\right)^{\frac{1}{3}}}{x^{3}} dx$

Let $x^{-2} - 1 = t$

$\Rightarrow \frac{-2}{x^{3}} dx = dt$

$= \int t^{\frac{1}{3}} \frac{dt}{-2} = \frac{-3}{8} t^{\frac{4}{3}} = \frac{-3}{8}\left(\frac{1}{x^{2}} - 1\right)^{\frac{4}{3}} + c$

$\therefore A = \frac{-3}{8}, B = 0$

(C) $\int \frac{(\cos 8x - \cos 7x)}{1 + 2\cos 5x} dx$

$= \int \frac{-2\sin\left(\frac{15x}{2}\right)\sin\frac{x}{2}}{1+2\cos 5x} dx$

$= -\int \frac{2\left(3\sin\frac{5x}{2} - 4\sin^{3}\frac{5x}{2}\right)\sin\frac{x}{2}}{1+2\left(1-2\sin^{2}\frac{5x}{2}\right)} dx$

$= -2\int \frac{\sin\frac{5x}{2}\left(3 - 4\sin^{2}\frac{5x}{2}\right)\sin\frac{x}{2}}{\left(3 - 4\sin^{2}\frac{(5x)}{2}\right)} dx$

$$= -\int 2\sin\frac{5x}{2}\sin\frac{x}{2}\,dx$$

$$= -\left(\int \cos 2x\,dx - \int \cos 3x\,dx\right)$$

$$= \frac{-\sin 2x}{2} + \frac{\sin 3x}{3} + c,\ A = \frac{-1}{2}, B = \frac{1}{3}$$

(D) $\int \frac{\log x}{x^3}\,dx$ $\quad \log_e x = t$, $\frac{1}{x}dx = dt$

$$= \int t\,e^{-2t}\,dt$$

$$= \frac{t\,e^{-2t}}{-2} - \int 1.\left(\frac{e^{-2t}}{-2}\right)dt + c$$

$$= \frac{-t}{2}e^{-2t} + \frac{1}{2}\int e^{-2t}\,dt + c$$

$$= -\frac{t}{2}e^{-2t} + \frac{1}{2}\times\frac{e^{-2t}}{-2} + c$$

$$= \frac{-t}{2}e^{-2t} - \frac{1}{4}e^{-2t} + c$$

$$= \frac{-(\log_e x)}{2x^2} - \frac{1}{4x^2} + c,\ A = \frac{-1}{2}, B = -1$$