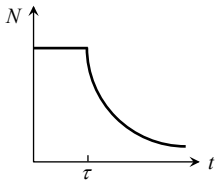
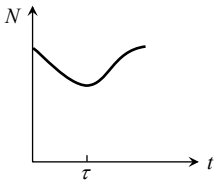
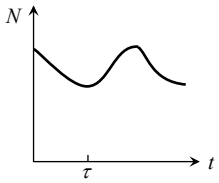
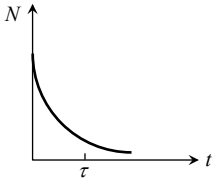
4. A radioactive sample consists of two distinct species having equal number of atoms initially. The mean life time of one species is τ and that of the other is 5τ. The decay products in both cases are stable. A plot is made of the total number of radioactive nuclei as a function of time. Which of the following figures best represents the form of this plot

[IIT-JEE (Screening) 2001]

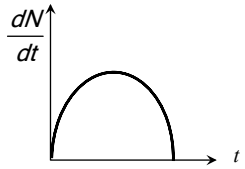
(a) 

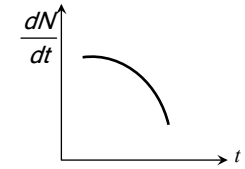
(b) 

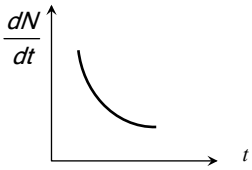
(c) 

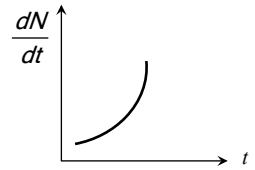
(d) 

5. Radioactive element decays to form a stable nuclide, then the rate of decay of reactant $\left(\frac{dN}{dt}\right)$ will vary with time (t) as shown in figure

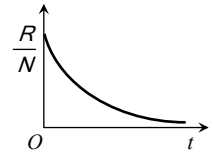
(a) 

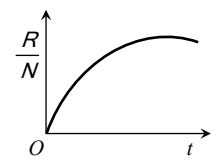
(b) 

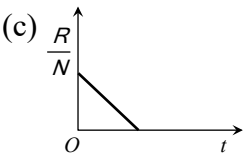
(c) 

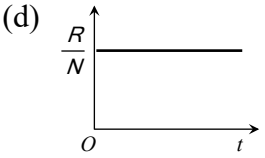
(d) 

6. A radioactive sample has N_0 active atoms at $t = 0$. If the rate of disintegration at any time is R and the number of atoms is N, then the ratio R/N varies with time as

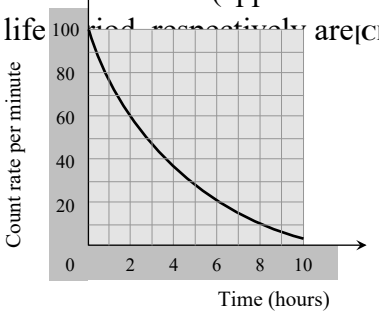
(a) 

(b) 

(c) 

(d) 

7. The count rate of 10g of radioactive material was measured at different times and this has been shown in the figure. The half life of material and the total counts (approximately) in the first half life period respectively are **[CPMT 1986]**



(a) 4h, 9000 (b) 3h, 14000

(c) 3h, 235 (d) 3h, 50 **[DCE 2000]**

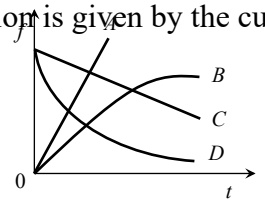
8. The fraction f of radioactive material that has decayed in time t, varies with time t. The correct variation is given by the curve

(a) A

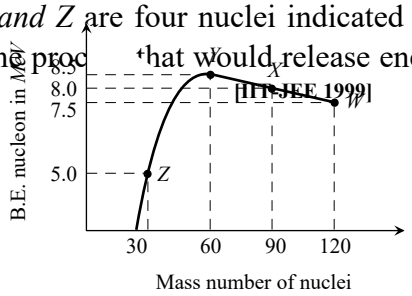
(b) B

(c) C

(d) D



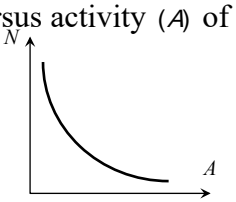
9. Binding energy per nucleon verses mass number curve for nuclei is shown in the figure. W, X, Y and Z are four nuclei indicated on the curve. The process that would release energy is **[IIT-JEE 1999]**

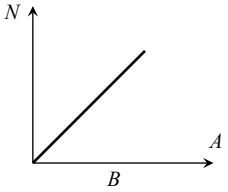


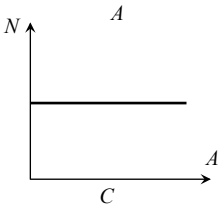
(a) $Y \rightarrow 2Z$ (b) $W \rightarrow X + Z$

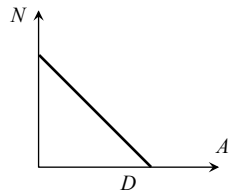
(c) $W \rightarrow 2Y$ (d) $X \rightarrow Y + Z$

10. The plot of the number (N) of decayed atoms versus activity (A) of a radioactive substance is

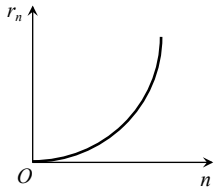
(a) 

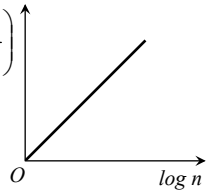
(b) 

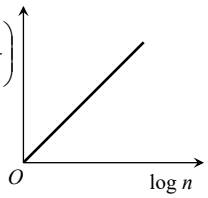
(c) 

(d) 

11. If in hydrogen atom, radius of n^{th} Bohr orbit is r_n, frequency of revolution of electron in n^{th} orbit is f_n choose the correct option

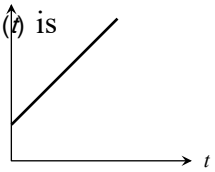
(a) 

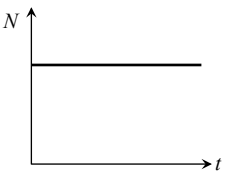
(b) $\log\left(\frac{r_n}{r_1}\right)$ 

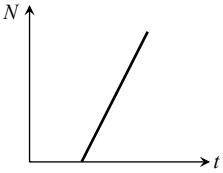
(c) $\log\left(\frac{f_n}{f_1}\right)$ 

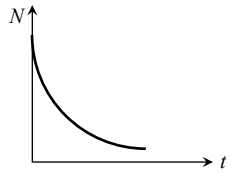
(d) Both (a) and (b)

12. The graph between the instantaneous concentration (N) of a radioactive element and time (t) is

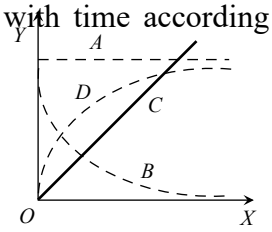
(a) 

(b) 

(c) 

(d) 

13. In Fig. X represents time and Y represent activity of a radioactive sample. Then the activity of sample, varies with time according to the curve



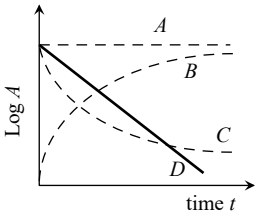
(a) A

(b) B

(c) C

(d) D

14. The graph which represents the correct variation of logarithm of activity (log A) versus time, in figure is



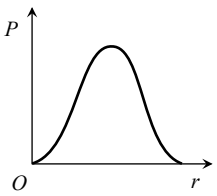
(a) A

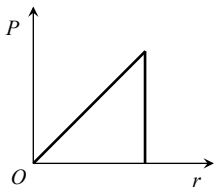
(b) B

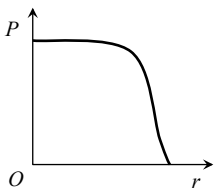
(c) C

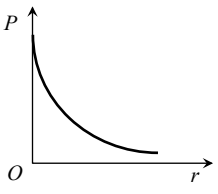
(d) D

15. The charge density in a nucleus varies with distance from the centre of the nucleus according to the curve in Fig.

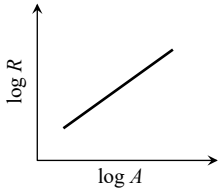
(a) 

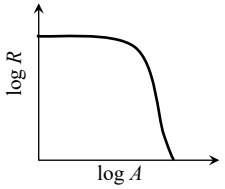
(b) 

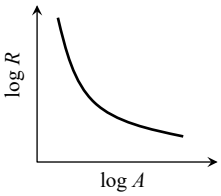
(c) 

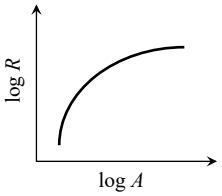
(d) 

16. The graph between log R and log A where R is the nuclear radius and *A is the mass number is*

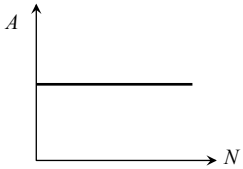
(a) 

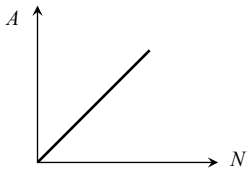
(b) 

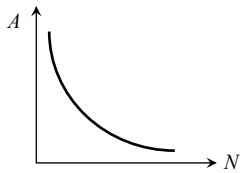
(c) 

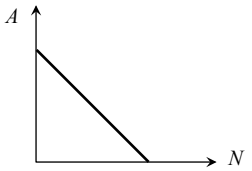
(d) 

17. The curve between the activity A of a radioactive sample and the number of active atoms N is

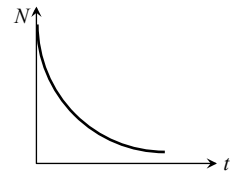
(a) 

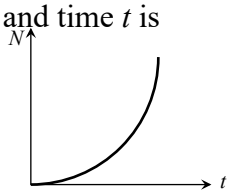
(b) 

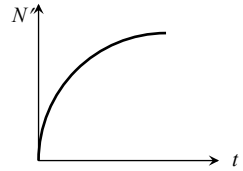
(c) 

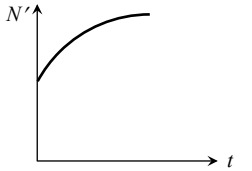
(d) 

18. The graph between number of decayed atoms N of a radioactive element and time t is

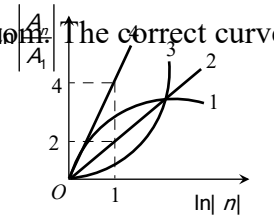
(a) 

(b) 

(c) 

(d) 

19. The figure shows a graph between $\ln\left|\frac{A_n}{A_1}\right|$ and $\ln|n|$, where A_n is the area enclosed by the nth orbit in a hydrogen like atom. The correct curve is



(a) 4

(b) 3

(c) 2

(d) 1

A R Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
(e) If assertion is false but reason is true.

1. Assertion : It is not possible to use ^{35}Cl as the fuel for fusion energy.

Reason : The binding energy of ^{35}Cl is too small.

[AIIMS 2005]

2. Assertion : ^{90}Sr from the radioactive fall out from a nuclear bomb ends up in the bones of human beings through the milk consumed by them. It causes impairment of the production of red blood cells.

Reason : The energetics β-particles emitted in the decay of ^{90}Sr damage the bone marrow.

[AIIMS 2004]

3. Assertion : Neutrons penetrate matter more readily as compared to protons.

Reason : Neutrons are slightly more massive than protons. **[AIIMS 2003]**

4. Assertion : Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason : According to classical physics all moving electrons radiate. **[AIIMS 2003]**

5. Assertion : Radioactive nuclei emit β^{-1} particles.

Reason : Electrons exist inside the nucleus.

[AIIMS 2003]

6. Assertion : ${}_{Z}X^{A}$ undergoes $2\alpha-$ decays. $2\beta-$ decays and $2\gamma-$ decays and the daughter product is ${}_{Z-2}Y^{A-8}$.

Reason : In α-decay the mass number decreases by 4 and atomic number decreases by 2. In β- decay the mass number remains unchanged, but atomic number increases by 1 only.

[AIIMS 2001]

7. Assertion : Density of all the nuclei is same.

Reason : Radius of nucleus is directly proportional to the cube root of mass number.

[AIIMS 2000]

8. Assertion : Isobars are the element having same mass number but different atomic number.

Reason : Neutrons and protons are present inside nucleus. **[AIIMS 1997]**

9. Assertion : The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.

Reason : Rutherford did α-particle scattering experiment.

10. Assertion : The positively charged nucleus of an atom has a radius of almost $10^{-15}m$.

Reason : In α-particle scattering experiment, the distance of closest approach for α-particles is $\simeq 10^{-15}m$.

11. Assertion : According to classical theory, the proposed path of an electron in Rutherford atom model will be parabolic.

Reason : According to electromagnetic theory an accelerated particle continuously emits radiation.

12. Assertion : Electrons in the atom are held due to coulomb forces.

Reason : The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

13. Assertion : The electron in the hydrogen atom passes from energy level $n=4$ to the $n=1$ level. The maximum and minimum number of photon that can be emitted are six and one respectively.

Reason : The photons are emitted when electron make a transition from the higher energy state to the lower energy state.

14. Assertion : Hydrogen atom consists of only one electron but its emission spectrum has many lines.

Reason : Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

15. Assertion : It is essential that all the lines available in the emission spectrum will also be available in the absorption spectrum.

Reason : The spectrum of hydrogen atom is only absorption spectrum.

16. Assertion : For the scattering of α-particles at a large angles, only the nucleus of the atom is responsible.

Reason : Nucleus is very heavy in comparison to electrons.

17. Assertion : All the radioactive elements are ultimately converted in lead.

Reason : All the elements above lead are unstable.

18. Assertion : Amongst alpha, beta and gamma rays, α-particle has maximum penetrating power.

Reason : The alpha particle is heavier than beta and gamma rays.

19. Assertion : The ionising power of β-particle is less compared to α-particles but their penetrating power is more.

Reason : The mass of β-particle is less than the mass of α-particle.

20. Assertion : The mass of β-particles when they are emitted is higher than the mass of electrons obtained by other means.
Reason : β-particle and electron, both are similar particles.

21. Assertion : Radioactivity of 10^8 undecayed radioactive nuclei of half life of 50 days is equal to that of 1.2×10^8 number of undecayed nuclei of some other material with half life of 60 days
Reason : Radioactivity is proportional to half-life.

22. Assertion : Fragments produced in the fission of U^{235} are radioactive.
Reason : The fragments have abnormally high proton to neutron ratio.

23. Assertion : Electron capture occurs more often than positron emission in heavy elements.
Reason : Heavy elements exhibit radioactivity.

24. Assertion : The mass of a nucleus can be either less than or more than the sum of the masses of nucleons present in it.
Reason : The whole mass of the atom is considered in the nucleus.

Answers

Atomic Structure

1	a	2	d	3	a	4	d	5	c
6	b	7	b	8	c	9	a	10	d
11	b	12	b	13	b	14	c	15	c
16	c	17	c	18	b	19	c	20	b
21	c	22	c	23	c	24	d	25	d
26	c	27	d	28	b	29	d	30	b
31	a	32	d	33	c	34	d	35	d
36	b	37	c	38	a	39	c	40	c
41	a	42	d	43	d	44	a	45	a
46	a	47	c	48	a	49	b	50	a
51	b	52	c	53	d	54	c	55	d
56	a	57	c	58	d	59	d	60	d
61	c	62	ad	63	d	64	b	65	b
66	b	67	c	68	a	69	b	70	c
71	a	72	b	73	b	74	d	75	b
76	d	77	d	78	b	79	a	80	d
81	a	82	a	83	b	84	b	85	d
86	c	87	a	88	c	89	a	90	b
91	d	92	b	93	c	94	c	95	b
96	a	97	c	98	b	99	a	100	b
101	a	102	c	103	a	104	b	105	d
106	b	107	b	108	c	109	d	110	c
111	a	112	a	113	a	114	b	115	d
116	b	117	d	118	a	119	b	120	a
121	b	122	b	123	b	124	d	125	a
126	d	127	d	128	c	129	c	130	d
131	a	132	c	133	c	134	a	135	c
136	a	137	c	138	d	139	d	140	b
141	b	142	a	143	b	144	a	145	d
146	a	147	b	148	d	149	b	150	b
151	a	152	d	153	a	154	a	155	c
156	d	157	d	158	d	159	c	160	a
161	c	162	b	163	a	164	c	165	b
166	a	167	b	168	a	169	b	170	c
171	c	172	a	173	d	174	c		

Nucleus, Nuclear Reaction

1	b	2	c	3	c	4	d	5	d
6	d	7	d	8	b	9	b	10	c
11	a	12	b	13	d	14	c	15	c
16	c	17	c	18	c	19	d	20	c
21	b	22	d	23	a	24	b	25	c
26	b	27	c	28	c	29	a	30	a
31	b	32	a	33		34	c	35	c
36	b	37	a	38	a	39	d	40	c
41	b	42	a	43	c	44	a	45	c
46	c	47	d	48	b	49	a	50	b
51	d	52	b	53	d	54	c	55	a
56	a	57	d	58	ad	59	c	60	a
61	c	62	b	63	a	64	a	65	d
66	c	67	a	68	b	69	b	70	d
71	b	72	d	73	bc	74	d	75	c
76	d	77	d	78	c	79	b	80	b
81	c	82	d	83	c	84	b	85	d
86	b	87	a	88	d	89	d	90	a
91	c	92	b	93	a	94	c	95	a

96	b	97	c	98	d	99	d	100	b
101	c	102	b	103	a	104	d	105	c
106	b	107	a	108	b	109	d	110	c
111	c	112	c	113	b	114	b	115	d
116	a	117	b	118	a	119	c	120	b
121	d	122	d	123	a	124	a	125	c
126	c	127	b	128	d	129	c	130	a
131	c	132	a	133	a	134	b	135	b
136	c	137	a	138	c	139	b	140	a
141	b	142	b	143	b	144	d	145	d
146	a	147	b	148	b	149	d	150	a
151	c	152	b	153	d	154	c	155	c
156	a	157	b	158	a	159	c	160	c
161	a	162	a	163	b	164	b	165	c
166	b	167	d	168	d	169	a	170	b
171	b	172	a	173	c	174	b	175	a
176	b	177	a	178	c	179	b		

Radioactivity

1	a	2	a	3	d	4	c	5	a
6	c	7	c	8	d	9	c	10	c
11	b	12	c	13	c	14	c	15	a
16	c	17	a	18	c	19	b	20	a
21	a	22	c	23	a	24	d	25	d
26	d	27	c	28	b	29	a	30	c
31	c	32	c	33	d	34	c	35	c
36	b	37	b	38	d	39	d	40	d
41	a	42	b	43	c	44	d	45	b
46	b	47	d	48	d	49	b	50	a
51	b	52	c	53	a	54	d	55	c
56	d	57	b	58	d	59	d	60	b
61	a	62	d	63	a	64	d	65	b
66	a	67	b	68	c	69	d	70	c
71	d	72	a	73	a	74	d	75	c
76	d	77	d	78	c	79	a	80	d
81	d	82	b	83	a	84	a	85	b
86	c	87	d	88	d	89	b	90	a
91	b	92	d	93	c	94	c	95	a
96	d	97	d	98	a	99	b	100	c
101	a	102	d	103	b	104	b	105	b
106	d	107	a	108	d	109	c	110	b
111	c	112	c	113	d	114	d	115	c
116	b	117	a	118	a	119	d	120	a
121	c	122	d	123	a	124	d	125	d
126	d	127	c	128	d	129	c	130	b
131	d	132	b	133	c	134	a	135	a

136	b	137	ac	138	b	139	c	140	c
141	d	142	c	143	a	144	d	145	c
146	b	147	d	148	b	149	b	150	c
151	c	152	a	153	b	154	b	155	d
156	b	157	c	158	c	159	d	160	c
161	a	162	d	163	c	164	c	165	d
166	d	167	c	168	c	169	b	170	d
171	b	172	c	173	b	174	a	175	c
176	d								

Critical Thinking Questions

1	c	2	c	3	b	4	a	5	a
6	a	7	a	8	d	9	b	10	d
11	a	12	a	13	a	14	d	15	c
16	d	17	c	18	d	19	c	20	d
21	b	22	c	23	d	24	a	25	d
26	d	27	c	28	c	29	cd	30	a
31	a	32	c	33	a	34	a	35	b
36	b	37	b	38	c	39	b	40	a
41	a	42	b	43	c	44	c	45	d
46	a	47	b	48	d	49	a	50	b
51	d	52	a	53	b	54	b	55	a
56	a	57	b	58	b	59	b	60	a
61	a	62	a	63	b	64	c	65	a

Graphical Questions

1	a	2	a	3	c	4	d	5	c
6	d	7	b	8	b	9	c	10	d
11	d	12	d	13	b	14	d	15	c
16	a	17	b	18	c	19	a		

Assertion and Reason

1	c	2	a	3	b	4	b	5	c
6	a	7	a	8	b	9	b	10	a
11	e	12	c	13	b	14	b	15	d
16	a	17	c	18	d	19	b	20	b
21	c	22	c	23	b	24	e		