विद्या ददाति विनयम्
Knowledge is Discipline
BJNP
Learning with the Speed of Mumbai and the Tradition of Kota

Max Marks: 60 **Date: 25.09.2022**

JB 1 MR BATCH
PHYSICS : DCT
Topic: Work, Power, Energy

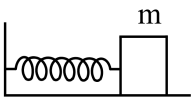
1. A force $\vec{F} = (5\hat{i} + 3\hat{j})$ Newton is applied over a particle which displaces it from its origin to the point $\vec{r} = (2\hat{i} - 1\hat{j})$ metres. The work done on the particle is

(a) –7 J (b) +13 J (c) +7 J (d) +11 J

2. Water falls from a height of 60 m at a rate of 15 kg/s to operate a turbine. The loss due to frictional force is 10% of energy. How much power is generated by the turbine? ($g = 10 m/s^2$)

(a) 8.1 kW (b) 10.2 kW (c) 12.3 kW (d) 7.0 kW

3. An impulsive force gives an initial velocity $-1.0\ ms^{-1}$ to the mass in the unstretched spring position in the fig. What is the amplitude of motion? give x as a function of time t for the oscillating mass. Given m = 3 kg and k = $1200\ Nm^{-1}$



(a) 10 cm (b) 5 cm (c) 9 cm (d) 50 cm

4. A body is allowed to fall from a height' h' above the ground. Then match the following.

List-I	List-II
(a) PE = KE	(e) At height h/2
(b) PE = 2KE	(f) Constant at any point
(c) KE = 2PE	(g) At height 2h/3
(d) PE + KE	(h) At height h/3

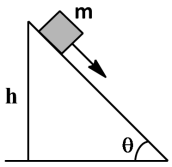
(a) a-e, b-g, c-h, d-f (b) a-g, b-e, c-f, d-h (c) a-f, b-g, c-e, d-h (d) a-e, b-h, c-g, d-f

5. A cradle is ‘h’ metres above the ground at the lowest position and ‘H’ metres when it is at the highest point. If ‘v’ is the maximum speed of the swing of total mass ‘m’, the relation between ‘h’ and ‘H’ is

(a) $1/2\ mv^2 + h = H$ (b) $(v^2/2g) + h = H$ (c) $(v^2/g) + 2h = H$ (d) $(v^2/2g) + H = h$

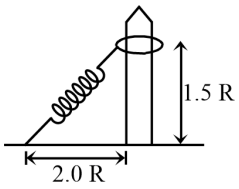
Space for Rough Work

6. A block of mass m sliding down an incline at constant speed is initially at a height h above the ground, as shown in the figure above. The coefficient of kinetic friction between the mass and the incline is μ if the mass continues to slide down the incline a constant speed, how much energy is dissipated by friction by the time the mass reaches the bottom of the incline?



(a) mgh / θ (b) mgh (c) μmgh / sinθ (d) mgh sin θ

7. A ring of mass m can slide over a smooth vertical rod as shown in the figure. The ring is connected to a spring of force constant k = 4 mg/R, where 2R is the natural length of the spring. The other end of spring is fixed to the ground at a horizontal distance 2R from the base of the rod. If the mass is released at a height 1.5R, then the velocity of the ring as it reaches the ground is:



(a) $\sqrt{gR}$ (b) $2\sqrt{gR}$ (c) $\sqrt{2gR}$ (d) $\sqrt{3gR}$

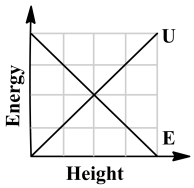
8. A body is allowed to fall freely from a height h. Then match the following energies with the heights from the ground.

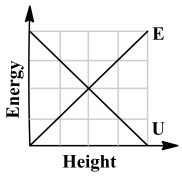
List - I	List -II
a) K.E = PE	e) $\frac{4h}{5}$
b) K.E = $\frac{1}{4}$ PE	f) $\frac{2h}{3}$
c) $\frac{1}{4}$ K.E = PE	g) $\frac{h}{2}$
d) K.E = $\frac{1}{2}$ PE	h) $\frac{h}{5}$
	i) 3h

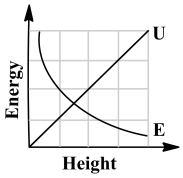
(a) a-g, b-e, c-h, d-f (b) a-g, b-i, c-f,d-h (c) a-h, b-e,c-g, d-f (d) a-f, b-h, c-g, d-e

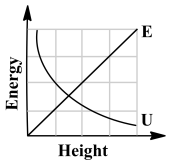
Space for Rough Work

9. Which of the following graphs is correct between kinetic energy (E), potential energy (U) and height (h) from the particle? (Total energy=K.E+P.E=Constant)

(a) 

(b) 

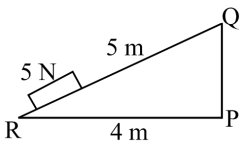
(c) 

(d) 

10. A body of mass 200 g falls from a height 200 m and its total PE is converted into KE at the point of contact of the body with earth surface. What is the decrease in PE of the body at the contact? ($g = 10\ m/s^2$)

(a) 200 J (b) 400 J (c) 600 J (d) 900 J

11. A weight of 5 N is moved up a frictionless inclined plane from R to Q as shown. What is the work done in joules?

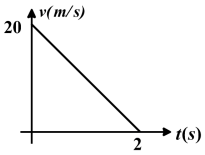


(a) 15 (b) 20 (c) 25 (d) 35

12. A body of mass m is suspended from a massless spring of natural length l. It stretches the spring through a vertical distance. The potential energy of the stretched spring is

(a) $mg(l + y)$ (b) $1/2\ mg(l + y)$ (c) $1/2\ mgy$ (d) mgy

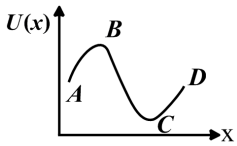
13. A particle is released from the top of two inclined rough surface of height 'h' each. The angle of inclination of the two planes are 30° and 60° respectively. All other factors (e.g. coefficient of friction, mass of black etc.) are same in both the cases. Let K_1 and K_2 be the kinetic energies of the particle at the bottom of the plane in two cases. Then



(a) $K_1 = K_2$ (b) $K_1 > K_2$ (c) $K_1 < K_2$ (d) Data insufficient

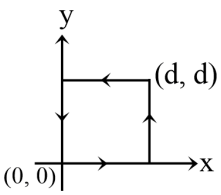
Space for Rough Work

14. The potential energy of a particle varies with distance as shown in the graph. The force acting on the particle is zero at



(a) C (b) B (c) B and C (d) A and D

15. The work done by the force $\vec{F} = A(y^2\hat{i} + 2x^2\hat{j})$ where A is a constant and x and y are in meters around the path shown is:



(a) Zero (b) Ad (c) Ad^2 (d) Ad^3

Space for Rough Work

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JB 1 MR BATCH
CHEMISTRY: DCT TEST
Topic: Structure of Atoms + Periodic + Mole Concept

16. If the radius of the first Bohr orbit is a_0, then the radius of the third orbit would be

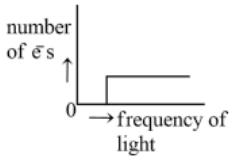
(a) $3 \times a_0$ (b) $6 \times a_0$ (c) $9 \times a_0$ (d) $1/9 \times a_0$

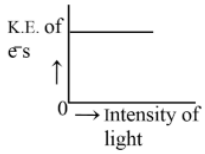
17. Two electrons occupying the same orbital are distinguished by

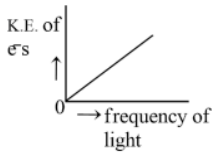
(a) Principal quantum number (b) Spin quantum number

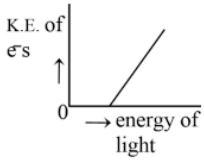
(c) Magnetic quantum number (d) Azimuthal quantum number

18. Which of the graphs shown below does not represent the relationship between incident light and the electron ejected form metal surface?

(a) 

(b) 

(c) 

(d) 

19. Which of the following has pseudo inert gas configuration

(a) Na^+ (b) Cu^+ (c) K^+ (d) S^{-2}

20. A photoelectric emitter has a threshold frequency ν_0 When light frequency 2 is incident, the speed of photo electrons is ν_0. When light of frequency 10 ν_0 is incident the speed of photoelectrons will be

(a) 5V (b) 3V (c) 20V (d) 8V

21. The ratio of the wavelengths of the first line in "Lyman series" of the spectrum of Hydrogen atom and first line in the Balmer series of the spectrum of $He^+$is

(a) $\frac{27}{20}$ (b) $\frac{20}{27}$ (c) $\frac{27}{5}$ (d) $\frac{5}{27}$

Space for Rough Work

22. A ball of mass 200 gm is moving with velocity of 10 ms^{-1}. If the error in measurement of velocity is 0.1%, the uncertainity in its position is

(a) 3.3×10^{-31}m (b) 3.3×10^{-27}m (c) 5.3×10^{-25}m (d) 2.64×10^{-32} m

23. Which of the following statement is not correct about the characteristics of cathode rays?

(a) They start from the cathode and move towards the anode

(b) They travel in straight line in the absence of an external electrical or magnetic field

(c) Characteristics of cathode rays do not depend upon the material of electrodes in cathode ray tube

(d) Characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube

24. If M represents molecular mass of Mn_3O_4 then what will be its equivalent mass if it undergoes disproportionation reaction as shown: $Mn_3O_4 \rightarrow MnO_4^- + Mn^{2+}$

(a) $\frac{M}{13}$ (b) $\frac{M}{2}$ (c) $\frac{15M}{26}$ (d) $\frac{26M}{15}$

25. $[Co(H_2N-CH_2-CH_2-NH_2)_3]_2S_3 \xrightarrow{\text{oxidation}} Co^{+4} + CO_3^{-2} + NO_3^- + SO_4^{-2}$

What is the equivalent weight of the reactant in the above reaction ?

(a) $\frac{3M}{182}$ (b) $\frac{M}{182}$ (c) $\frac{11M}{182}$ (d) $\frac{7M}{182}$

26. 100 mL each of 2 N H_2O_2 and 11.2 V H_2O_2 solution are mixed, then the final solution is equivalent to : (Assume 1 mole of an ideal gas occupies 22.4 L at STP)

(a) 3M H_2O_2 solution (b) 0.5 N H_2O_2 solution

(c) 34 g/L H_2O_2 solution (d) 2.55 g/L H_2O_2 solution

27. How many moles of $KMnO_4$ are needed to oxidise a mixture of 1 mole of each $FeSO_4$ and FeC_2O_4 in acidic medium?

(a) $\frac{4}{5}$ (b) $\frac{5}{4}$ (c) $\frac{3}{4}$ (d) $\frac{5}{3}$

Space for Rough Work

28. In the conversion $NH_2OH \rightarrow N_2O_2$ the equivalent weight of NH_2OH will be:

(a) $\frac{M}{4}$ (b) $\frac{M}{2}$ (c) $\frac{M}{5}$ (d) $\frac{M}{1}$

29. Which of the following relations is incorrect for solutions?

(a) 3N $Al_2(SO_4)_3$= 0.5 M $Al_2(SO4)_3$

(b) 3 M H_2SO_4 = 6 N H_2SO_4

(c) 1 M H_3PO_4 = 1/3 N H_3PO_4

(d) 1 M $Al_2 (SO_4)_3$ = 6 N $Al_2(SO_4)_3$

30. Volume of 0.1 M ferrous oxalate solution required to react completely with 60 ml of 0.1 N acidified $KMnO_4$ solution.

(a) 30mL (b) 20mL (c) 150mL (d) 10mL

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JB 1 MR BATCH
PHYSICS : DCT ANSWER KEY
Topic: Work, Power, Energy

1.	(c)	2.	(a)	3.	(b)	4.	(a)	5.	(b)
6.	(b)	7.	(b)	8.	(a)	9.	(a)	10.	(b)
11.	(a)	12.	(c)	13.	(c)	14.	(c)	15.	(d)

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JB 1 MR BATCH
CHEMISTRY: DCT ANSWER KEY
Topic: Structure of Atoms + Periodic + Mole Concept

16.	(c)	17.	(b)	18.	(c)	19.	(b)	20.	(b)
21.	(b)	22.	(d)	23.	(d)	24.	(c)	25.	(b)
26.	(c)	27.	(a)	28.	(b)	29.	(c)	30.	(b)