

# JEE Advanced Question Paper

## Session:2023

*Created by : Mustafa Kasubhai Wala*

### Instructions:

- These question paper contain Multiple choose , True false , Match the column type questions.
- These section contains **FOUR(04)** questions.
- Each question has **FOUR** options (A),(B),(C) and (D).**ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:  
Full Marks : +3 if **ONLY** the correct option is chosen;  
zero Marks : 0 if none of the option is chosen (i.e the questions unanswered);  
Negative Marks : -1 In all other cases
- For example, if [A], [C] and [D] are all the correct options for a question, darkening all these three will get +4 marks; darkening only [A] and [D] will get +2 marks; and darkening [A] and [B] will get -2 marks, as a wrong option is also darkened

## Questions:

**Q1.** Let

$$\alpha = \sum_{k=1}^{\infty} \sin^{2k}\left(\frac{\pi}{6}\right).$$

Let  $g : [0,1] \rightarrow \mathbb{R}$  be the function defined by

$$g(x) = 2^{\alpha x} + 2^{\alpha(1-x)}$$

Then, which of the following statements is/are TRUE ?

- (a) The minimum value of  $g(x)$  is  $2^{\frac{7}{6}}$
  - (b) The maximum value of  $g(x)$  is  $1 + 2^{\frac{1}{3}}$
  - (c) The function  $g(x)$  attains its maximum at more than one point
  - (d) The function  $g(x)$  attains its minimum at more than one point
- Q2.** Let  $\alpha, \alpha_2, \alpha_3$  be an arithmetic progression with  $\alpha_1 = 7$  and common difference 8. Let  $T_1, T_2, T_3, \dots$  be such that  $T_1 = 3$  and  $T_{n+1} - T_n = \alpha_n$  for  $n \geq 1$ . Then, which of the following is/are **TRUE**?
- (a)  $T_{20} = 1604$
  - (b)  $\sum_{k=1}^{20} T_k = 10510$
  - (c)  $T_{30} = 3454$
  - (d)  $\sum_{k=1}^{30} T_k = 35610$ .

**Q3.** For positive integer  $n$ , define

$$f(n) = n + \frac{16 + 5n - 3n^2}{4n + 3n^2} + \frac{32 + n - 3n^2}{8n + 3n^2} + \frac{48 - 3n - 3n^2}{12n + 3n^2} + \dots + \frac{25n - 7n^2}{7n^2}.$$

Then, the value of  $\lim_{n \rightarrow \infty} f(n)$  is equal to

- (a)  $3 + \frac{4}{3} \log_e 7$
- (b)  $4 - \frac{3}{4} \log_e \left(\frac{7}{3}\right)$
- (c)  $4 - \frac{4}{3} \log_e \left(\frac{7}{3}\right)$
- (d)  $3 + \frac{3}{4} \log_e 7$

- Q4.** A spring-block is resting on a frictionless floor as shown in the figure. The spring constant is  $2.0 \text{ N m}^{-1}$  and the mass of the block is  $2.0 \text{ kg}$ . ignore the mass of the spring. Initially the spring is in an unstretched condition. Another block of mass  $1.0 \text{ kg}$  moving with a speed of  $2.0 \text{ ms}^{-1}$  collides elastically with the first block. The collision is such that the  $2.0 \text{ kg}$  block does not hit the wall. distance, in meters, between the two blocks when the spring returns to its unstretched position for the first time after the collision is \_\_\_\_\_

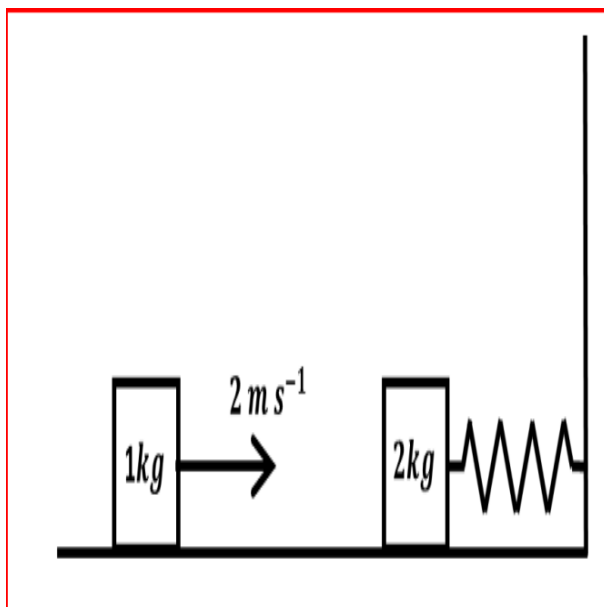
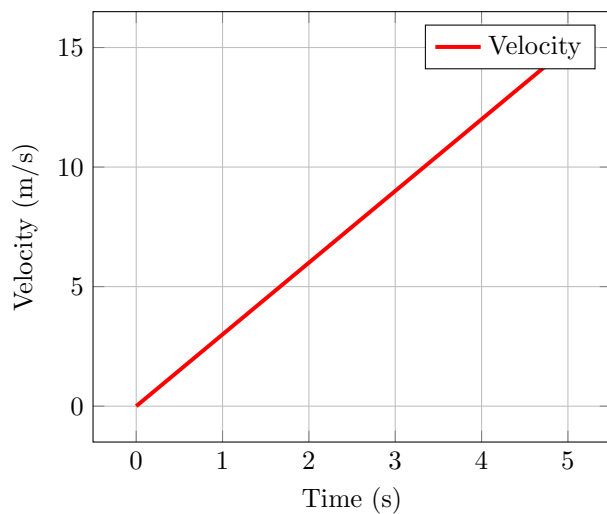


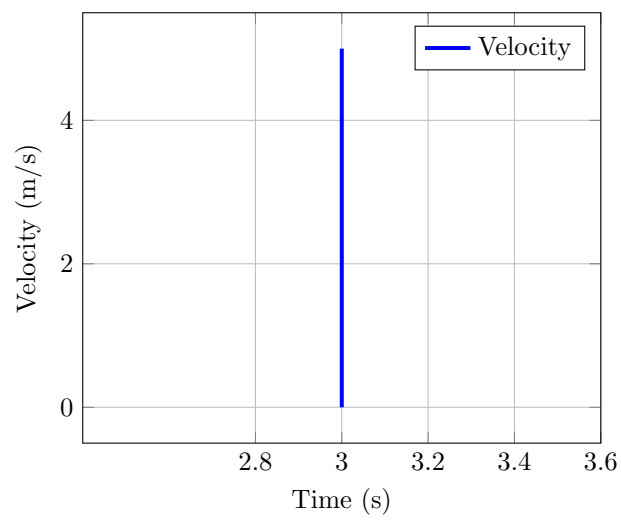
Figure 1:

- Q5.** A body is thrown vertically upwards. Which one of the following graphs correctly represents the velocity vs time ?

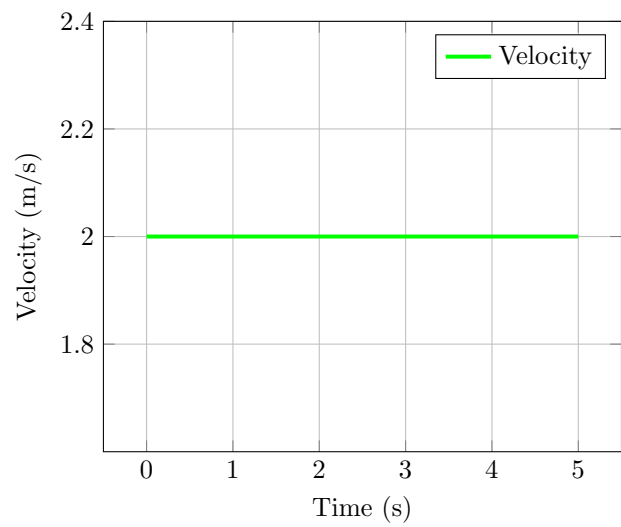
velocity time graph (A)

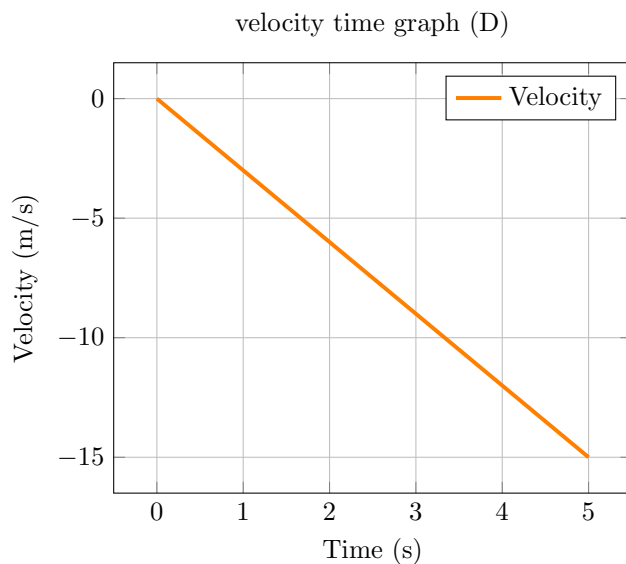


velocity time graph (B)



velocity time graph (C)





- (a) Graph (A)
- (b) Graph (B)
- (c) both option (a) and (b) are correct .
- (d) Graph (C) and (D) are correct

**Q6.** Match the following terms in column A with their corresponding description in Column B.

**Column A**

- (A1) An electric bulb
- (A2) Depositing a thin layer of metal using electricity
- (A3) Electrode that is joined with the positive terminal of the battery
- (A4) ordinary water

**Column B**

- (B1) A good conductor of electricity
- (B2) Anode
- (B3) Electroplating
- (B4) Heating effect of current

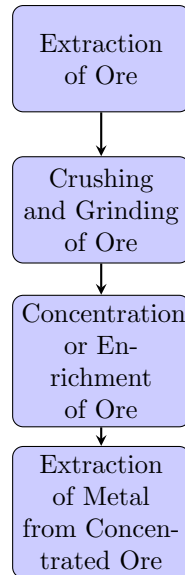
- (a) A1-B1 , A2-B2 , A3-B3 , A4-B4
- (b) A1-B4 , A2-B3 , A3-B2 , A4-B1
- (c) A1-B2 , A2-B1 , A3-B4 , A4-B3
- (d) A1-B3 , A2-B4 , A3-B1 , A4-B2

**Q7.** Match the physical quantity in column-I with the respective dimension in column-II and choose the correct option.

	Column (A)		Column(B)
I	Spring constant	(P)	$[ML^2T^0]$
II	Moment of Inertia	(Q)	$[M^0L^0t^{-1}]$
III	Angular momentum	(R)	$[ML^0T^{-2}]$
IV	Angular speed	(S)	$[MLT^{-1}]$

- (a) (1) I(P) , II(Q) , III(R) , IV(S)  
 (b) (1) I(R) , II(P) , III(Q) , IV(S)  
 (c) (1) I(S) , II(S) , III(Q) , IV(P)  
 (d) (1) I(P) , II(P) , III(S) , IV(Q)

**Q8.** From the below flow chart which process is called as comminution processes.



- (a) Extraction of Ore .  
 (b) Crusing and Grinding of ore .  
 (c) Concentration Enrichment of ore.  
 (d) Extraction of Metal from Concentrated Ore.

**Q9.** The capacitance of capacitor can be varied by filling dielectric constant  $\mathbf{K} = 4$  as shown in figure. As X varies, the capacitance changes. For  $X = \frac{d}{3}$ , the equivalent capacitance is  $\mathbf{G}$  and for  $X = \frac{2d}{3}$ , the equivalent capacitance is  $2 \mu \mathbf{F}$ . Find the value of  $C_1$  in  $\mu \mathbf{F}$

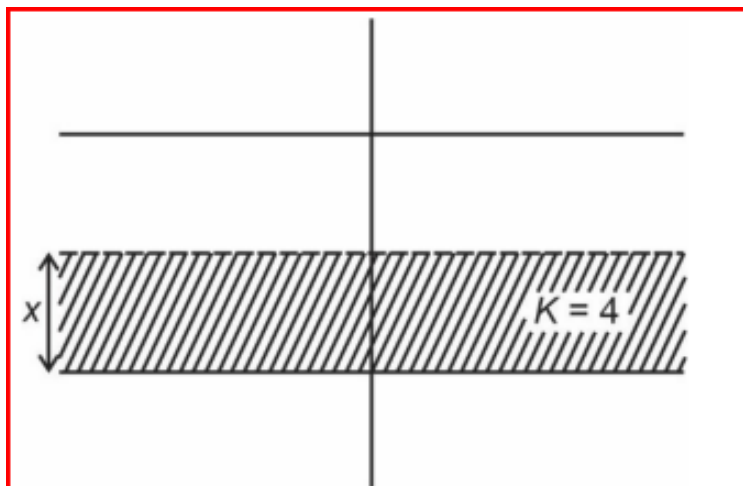


Figure 2:

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

**Q10.** To check the principle of multiple proportions, a series of pure binary compounds  $P_mQ_n$  were analysed and their composition is tabulated below. The correct option(s) is (are)

compound	Weight of % P	Weight of % Q
1	50	50
2	44.4	55.6
3	40	60

- (a) if empirical formula of compound 3 is  $P_3Q_4$ , then empirical formula of compound .
- (b) if empirical formula of compound 3 is  $P_3Q_2$  and atomic weight of element P is 20, then the atomic weight of Q is 45.
- (c) if empirical formula of compound 2 is PQ, then the empirical formula of compound 1 is  $P_5Q_4$ .
- (d) if atomic weight of P and Q are 70 and 35, then the empirical formula of compound 1 is  $P_2Q$