

SAMPLE PAPER 2: PAPER 1

QUESTION 8 (50 MARKS)

Question 8 (a)

$$M = \log_{10} \left(\frac{s}{s} \right) = \log_{10} 1 = 0$$

Question 8 (b)

$$M_1 = \log_{10} \left(\frac{A_1}{s} \right) = 8.3$$

$$M_2 = \log_{10} \left(\frac{4A_1}{s} \right)$$

$$M_2 - M_1 = \log_{10} \left(\frac{4A_1}{s} \right) - \log_{10} \left(\frac{A_1}{s} \right)$$

$$M_2 - 8.3 = \log_{10} \left(\frac{4A_1}{s} \times \frac{s}{A_1} \right)$$

$$M_2 - 8.3 = \log_{10} 4$$

$$\therefore M_2 = \log_{10} 4 + 8.3 = 8.9$$

Question 8 (d)

$$M_1 = 5.9, A = A_1$$

$$M_1 = \log_{10} \left(\frac{A_1}{s} \right) = 5.9 \Rightarrow \frac{A_1}{s} = 10^{5.9}$$

$$M_2 = 6.5, A = A_2$$

$$M_2 = \log_{10} \left(\frac{A_2}{s} \right) = 6.5 \Rightarrow \frac{A_2}{s} = 10^{6.5}$$

$$\text{Fractional change in amplitude} = \frac{A_2 - A_1}{A_1} = \frac{A_2}{A_1} - 1$$

$$= \frac{10^{6.5} \times s}{10^{5.9} \times s} - 1 = 10^{0.6} - 1 = 2.98$$

$$\% \text{ change} = 298\%$$

Question 8 (e)

$$6.5 = \log_{10} \left(\frac{A}{10^{-4}} \right)$$

$$10^{6.5} = \frac{A}{10^{-4}}$$

$$\therefore A = 10^{6.5} \times 10^{-4} = 10^{2.5} = 316 \text{ cm}$$

Question 8 (f)

$$E = 1.74 \times 10^{(5+1.44 \times 4.3)} = 2.7 \times 10^{11} \text{ J}$$

Question 8 (c)

$$M_1 = \log_{10} \left(\frac{A_1}{s} \right) = 8.3$$

$$M_2 = \log_{10} \left(\frac{A_2}{s} \right) = 4$$

$$M_1 - M_2 = \log_{10} \left(\frac{A_1}{s} \right) - \log_{10} \left(\frac{A_2}{s} \right)$$

$$4.3 = \log_{10} \left(\frac{A_1}{s} \times \frac{s}{A_2} \right) = \log_{10} \left(\frac{A_1}{A_2} \right)$$

$$\therefore \frac{A_1}{A_2} = 10^{4.3} = 19953$$

Modified Mercalli Scale		Richter Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing.	2
III	Felt noticeably indoors, but not always recognised as earthquake; standing autos rock slightly, vibration like passing truck.	2.5
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; autos rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys; sand and mud ejected; drivers of autos disturbed	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos	4.5
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up in air	7
		7.5
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