3 Fig. 3.1 shows a mass-spring system placed on a frictionless slope. The slope has an angle of θ from the horizontal. When a block of mass m is hung, the spring stretches by an extension of e and the mass remains in equilibrium. The spring is further extended by x downwards, along the slope, and released for the mass-spring system to oscillate. The spring constant is k.

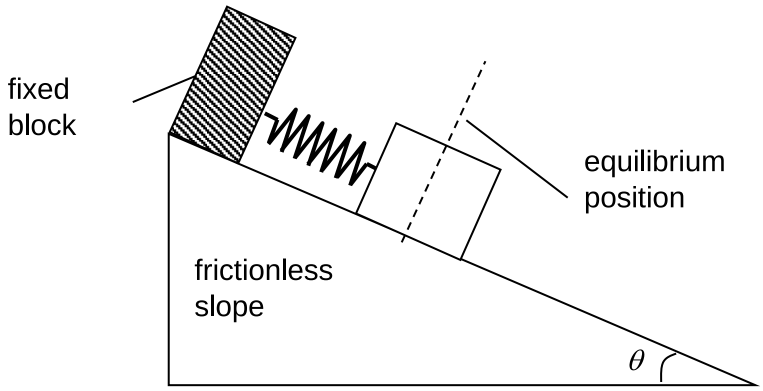

Fig. 3.1

(a) By using Newton's second law, show that the acceleration a of the block at the lowest point is given by $a = -\dfrac{k}{m}x$.

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[2]

(b) The amplitude of oscillation of the mass-spring system is 3.0 cm. Calculate the position of the mass from equilibrium when the speed of the mass is 25 % of the maximum speed.

position = ... cm [2]

(c) A student removes the fixed block and attaches a variable frequency oscillator to the mass-spring system, as shown in Fig. 3.2.

Fig. 3.3 shows the variation of the amplitude of mass with the frequency of the oscillator.

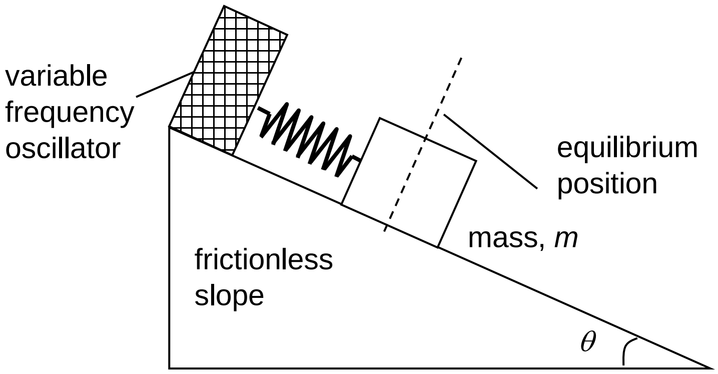

Fig. 3.2

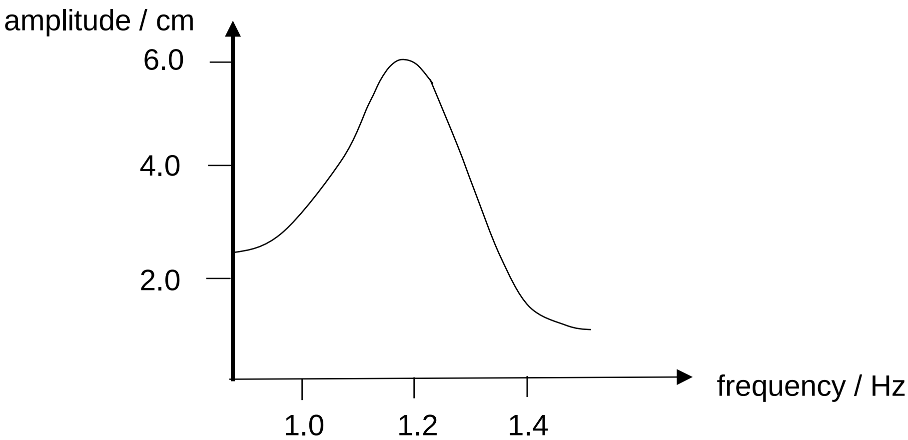

Fig. 3.3

(i) Explain the phenomenon illustrated in Fig. 3.3.

....

....

....

....

.... [2]

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(ii) Using Fig. 3.3 calculate the magnitude of maximum acceleration of the mass.

acceleration = ... m s^{-2} [2]

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