3 **(a)** Explain what is meant by *damped* oscillation.

…….....

……..... [1]

(b) **(i)** Fig. 3.1 shows a spring-mass system hanging vertically from a fixed support. The mass is displaced vertically upwards by 3.0 cm and released to vibrate in simple harmonic motion with a period of 2.0 s. The effects of air resistance is neglected.

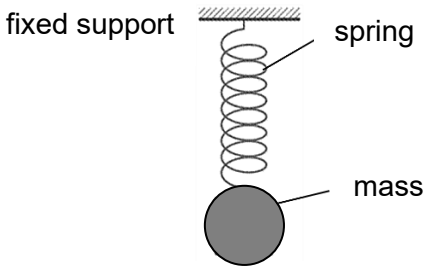

Fig. 3.1

Calculate the magnitude of the maximum acceleration of the mass.

maximum acceleration = ……m s^{-2} [2]

(ii) The same spring-mass system in **(b)(i)** is now displaced vertically upwards by 3.0 cm and released to oscillate within a low viscosity oil in a container as shown in Fig. 3.2.

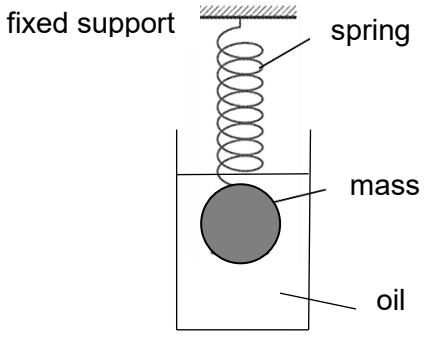

Fig. 3.2

Sketch on the axes of Fig. 3.3, the variation of displacement with time for the mass oscillating in the oil.

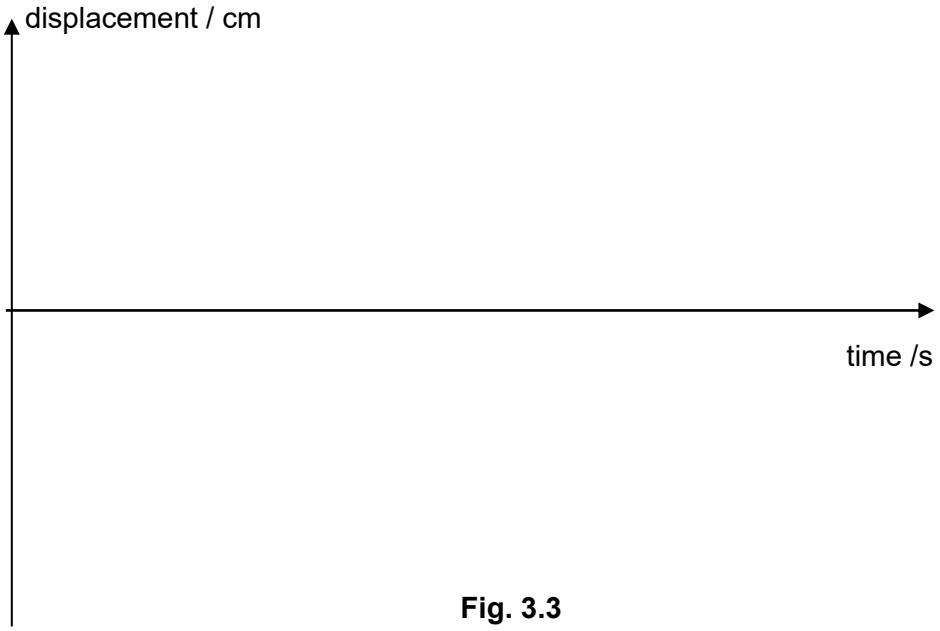

Fig. 3.3

[2]

(c) The same spring-mass system in **(b)(i)** is now supported by a movable support as shown in Fig. 3.4. The effects of air resistance is neglected.

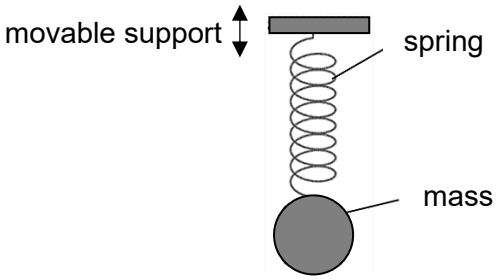

Fig. 3.4

A periodic force is now applied to the support such that the mass undergoes forced oscillations with very large amplitude.

State the physical phenomenon associated with this and the condition necessary for this to take place.

physical phenomenon:…..……..……

condition:…..……..……..…… [2]

(d) A car's suspension system helps to damp its vertical oscillations as it is driven along a rough road.

State the type of damping and describe the importance of such damping for a working car's suspension system.

…….....

…….....

……..... [2]