

3 (a) Define

(i) *stress*,

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.....[1]

(ii) *strain*.

.....  
.....[1]

(b) Explain the term *elastic limit*.

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.....[1]

(c) Explain the term *ultimate tensile stress*.

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.....  
.....[2]

(d) (i) A **ductile** material in the form of a wire is stretched up to its breaking point. On Fig. 3.1, sketch the variation with extension  $x$  of the stretching force  $F$ .



Fig. 3.1

[2]

- (ii) On Fig. 3.2, sketch the variation with  $x$  of  $F$  for a **brittle** material up to its breaking point.



**Fig. 3.2**

[1]

- (e) (i) Explain the features of the graphs in (d) that show the characteristics of ductile and brittle materials.

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.....[2]

- (ii) The force  $F$  is removed from the materials in (d) just before the breaking point is reached. Describe the subsequent change in the extension for

1. the ductile material,

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.....[1]

2. the brittle material.

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.....[1]