1 A wire of length L and cross-sectional area A is stretched a distance e by a tensile force. The Young modulus of the material of the wire is E.

Which expression gives the elastic energy stored in the stretched wire?

A $\frac{1}{2}\frac{EAe^2}{L}$ ⬭

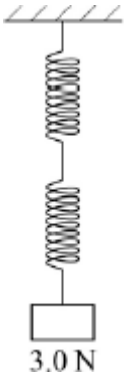
B $\frac{1}{2}\frac{L}{Ae}$ ⬭

C $\frac{1}{2}\frac{Ae^2}{EL}$ ⬭

D $\frac{1}{2}\frac{EAL}{e}$ ⬭

(Total 1 mark)

2 A load of 3.0 N is attached to a spring of negligible mass and spring constant 15 N m^{-1}.



What is the energy stored in the spring?

A 0.3 J ⬭

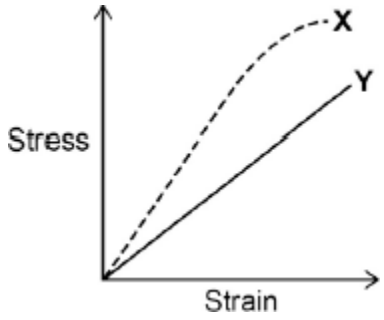
B 0.6 J ⬭

C 0.9 J ⬭

D 1.2 J ⬭

(Total 1 mark)

3 The diagram shows how the stress varies with strain for metal specimens X and Y which are different. Both specimens were stretched until they broke.



Which of the following is incorrect?

A X is stiffer than Y ⬭

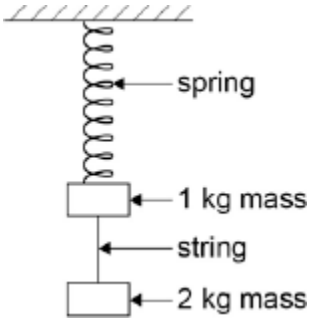
B X has a higher value of the Young modulus ⬭

C X is more brittle than Y ⬭

D Y has a lower maximum tensile stress than X ⬭

(Total 1 mark)

4 Two masses hang at rest from a spring, as shown in the diagram. The string separating the masses is burned through.



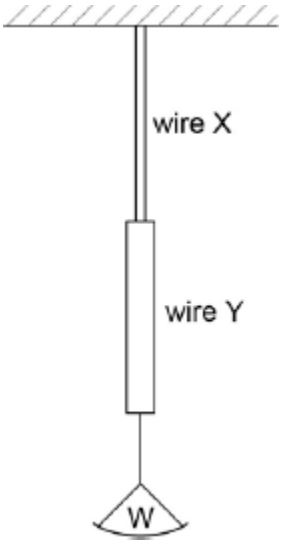
Which of the following gives the accelerations of the two masses as the string breaks?

acceleration of free fall = g

	acceleration of 1 kg mass upwards in m s^{-2}	acceleration of 2 kg mass downwards in m s^{-2}	
A	3 g	1 g	⬭
B	2 g	2 g	⬭
C	2 g	1 g	⬭
D	1 g	1 g	⬭

(Total 1 mark)

5 Two vertical copper wires X and Y of equal length are joined as shown. Y has a greater diameter than X. A weight W is hung from the lower end of Y.



Which of the following is correct?

A The strain in X is the same as that in Y. ⬭

B The stress in Y is greater than that in X. ⬭

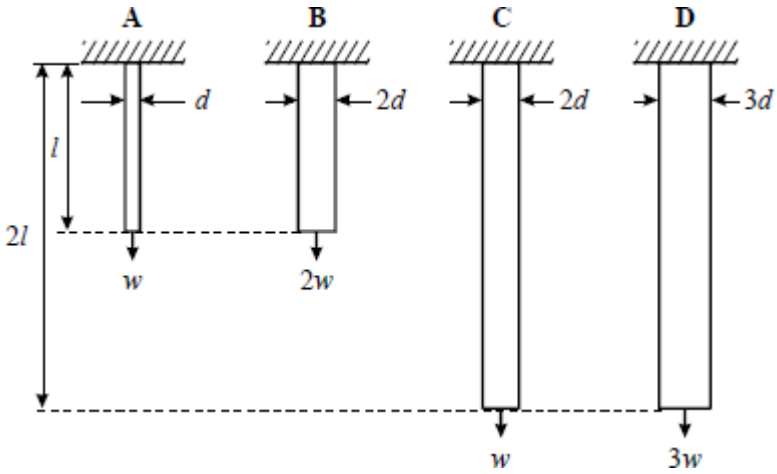
C The tension in Y is the same as that in X. ⬭

D The elastic energy stored in X is less than that stored in Y. ⬭

(Total 1 mark)

6 The four bars **A**, **B**, **C** and **D** have diameters, lengths and loads as shown. They are all made of the same material.

Which bar has the greatest extension?



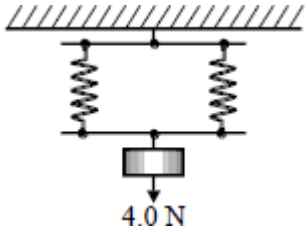
(Total 1 mark)

7 For which of the following relationships is the quantity y related to the quantity x by the relationship $x \propto \frac{1}{y}$?

	x	y
A	energy stored in a spring	extension of the spring
B	gravitational field strength	distance from a point mass
C	de Broglie wavelength of an electron	momentum of the electron
D	period of a mass-spring system	spring constant (stiffness) of the spring

(Total 1 mark)

8 A load of 4.0 N is suspended from a parallel two-spring system as shown in the diagram.



The spring constant of each spring is 20 N m^{-1}. The elastic energy, in J, stored in the system is

A 0.1

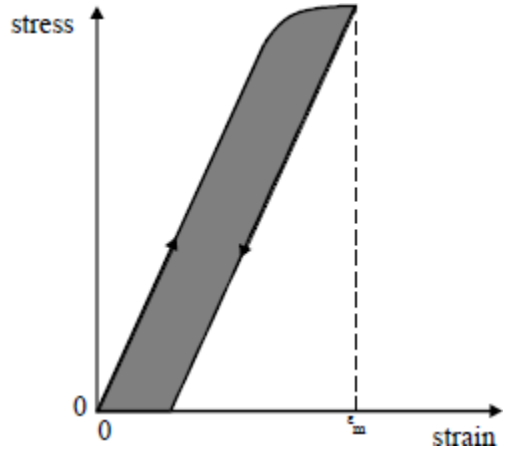
B 0.2

C 0.4

D 0.8

(Total 1 mark)

9 The graph shows the variation of stress with strain for a ductile alloy when a specimen is slowly stretched to a maximum strain of ε_m and the stress is then slowly reduced to zero.



The shaded area

A represents the work done per unit volume when stretching the specimen

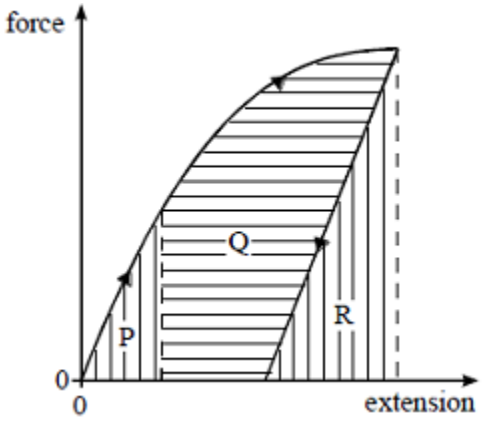
B represents the energy per unit volume recovered when the stress is removed

C represents the energy per unit volume which cannot be recovered

D has units of J m^{-1}

(Total 1 mark)

10 The force on a sample of a material is gradually increased and then decreased. The graph of force against extension is shown in the diagram.



The increase in thermal energy in the sample is represented by area

A R

B $P + Q$

C $P + Q + R$

D $P + Q - R$

(Total 1 mark)

11 A stone is projected horizontally by a catapult consisting of two rubber cords. The cords, which obey Hooke's law, are stretched and released. When each cord is extended by x, the stone is projected with a speed v. Assuming that all the strain energy in the rubber is transferred to the stone, what is the speed of the stone when each cord is extended by $2x$?

A v

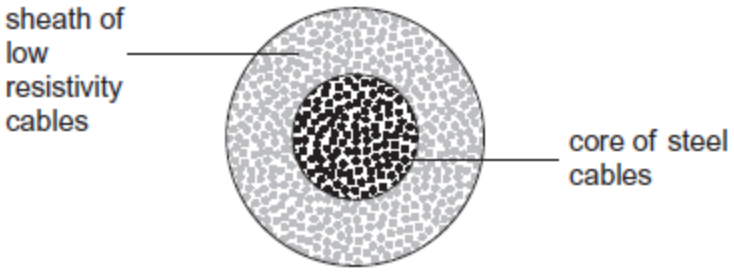
B $\sqrt{2v}$

C $2v$

D $4v$

(Total 1 mark)

12 The overhead cables used to transmit electrical power by the National Grid usually consist of a central core of steel cables surrounded by a sheath of cables of low resistivity material, such as aluminium.



What is the main purpose of the steel core?

A To force more current into the outer sheath.

B To provide additional current paths through the cables.

C To reduce the power lost from the cables.

D To increase the mechanical strength of the cables.

(Total 1 mark)

Mark schemes

1	A	**[1]**
2	A	**[1]**
3	C	**[1]**
4	C	**[1]**
5	C	**[1]**
6	A	**[1]**
7	C	**[1]**
8	B	**[1]**
9	C	**[1]**
10	B	**[1]**
11	C	**[1]**
12	D	**[1]**

Examiner reports

12 The synoptic (or “common sense”) element in answering this question made the question more difficult than it really should have been. With a facility of 43% it was the most difficult question in this test. When studying power transmission, students should know that it is essential to minimise I^2R losses from the cables. This is done by using high voltage (to reduce the current for a given amount of power) and by employing cables of low resistance. However, the cables also need to be mechanically strong so that they will help to support their own weight. The electrical good conductors such as copper and aluminium tend to be mechanically weak, so in practice the cables are reinforced by incorporating a stronger material. 37% of the students thought that the principal reason for the steel core was that it would reduce the power lost from the cables (distractor C).