U6 Week2

All working must be shown in full on the M.A.T

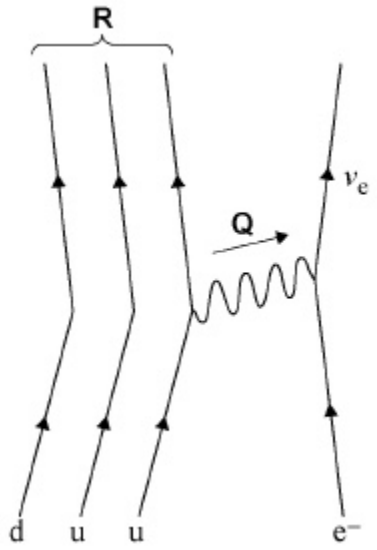
Name: _____

Class: _____

Date: _____

Time:	**30 minutes**
Marks:	**30 marks**
Comments:	**1 mark correct for workings, 1 mark correct answer. Do not write on and submit this paper. USE THE MCQ Answer Template on GoL**

1 The partially completed diagram represents electron capture.



Which row identifies the exchange particle **Q** and the quark structure of particle **R**?

	Particle Q	Quark structure of particle R	
A	W^-	uuu	⬭
B	W^+	dud	⬭
C	W^+	uuu	⬭
D	W^-	dud	⬭

(Total 1 mark)

2 Measurements are made to determine the tension, length and mass per unit length of a string stretched between two supports. The percentage uncertainties in these measurements are shown below.

Quantity	Percentage uncertainty
Length	0.80%
Tension	4.0%
Mass per unit length	2.0%

A stationary wave is formed on the string.

What is the percentage uncertainty in the calculated value of the frequency of the first harmonic?

A 1.8% ⬭

B 3.8% ⬭

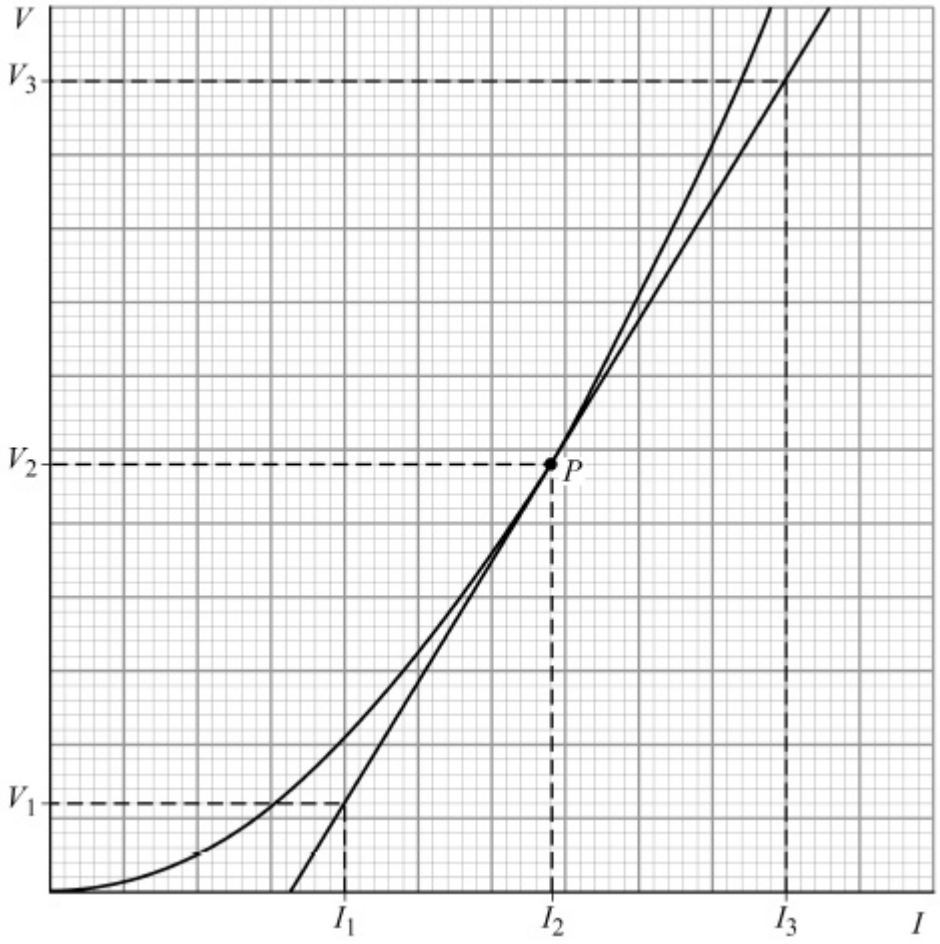
C 6.8% ⬭

D 13% ⬭

(Total 1 mark)

3 The graph shows how the potential difference V across an electrical component varies with current I in the component.

A tangent has been drawn on the curve at point P for a current of I_2.



What is the resistance of the electrical component when the current in the component is I_2?

A $\frac{V_3 - V_1}{2I_2}$ ○

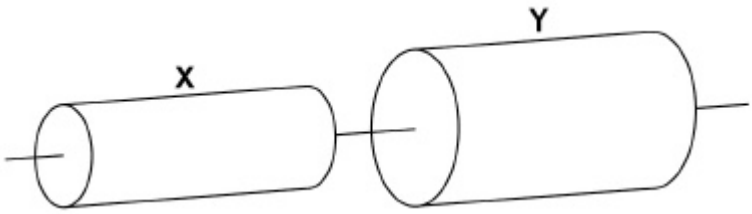
B $\frac{V_3 - V_1}{I_3 - I_1}$ ○

C $\frac{V_2}{I_2}$ ○

D $\frac{2V_2}{I_2 - I_1}$ ○

(Total 1 mark)

4 The two resistors shown are both uniform cylinders of equal length made from the same conducting putty.



The diameter of **Y** is twice that of **X**. The resistance of **Y** is R.

What is the total resistance of the combination?

A $\frac{4R}{5}$ ○

B $3R$ ○

C $4R$ ○

D $5R$ ○

(Total 1 mark)

5 A particle of mass m has a kinetic energy of E.

What is the de Broglie wavelength of this particle?

A $\frac{h}{\sqrt{(2Em^2)}}$ ⬭

B $\frac{h}{\sqrt{2E}}$ ⬭

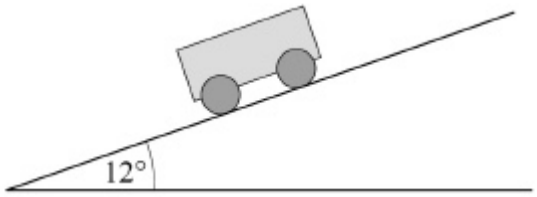
C $\frac{h}{\sqrt{\left(\frac{2E}{m^2}\right)}}$ ⬭

D $\frac{h}{\sqrt{2Em}}$ ⬭

(Total 1 mark)

6 A car's engine produces a useful output power of 6.5×10^4 W

The car of mass 950 kg is moving up a hill at a steady speed.
The slope of the hill is 12° to the horizontal. Resistive forces on the car are negligible.



What is the steady speed of the car?

A 7.0 m s^{-1} ⬭

B 12 m s^{-1} ⬭

C 34 m s^{-1} ⬭

D 68 m s^{-1} ⬭

(Total 1 mark)

7 Two points on a progressive wave have a phase difference of $\frac{\pi}{6}$ rad

The speed of the wave is 340 m s^{-1}

What is the frequency of the wave when the minimum distance between the two points is 0.12 m?

A 240 Hz ⬭

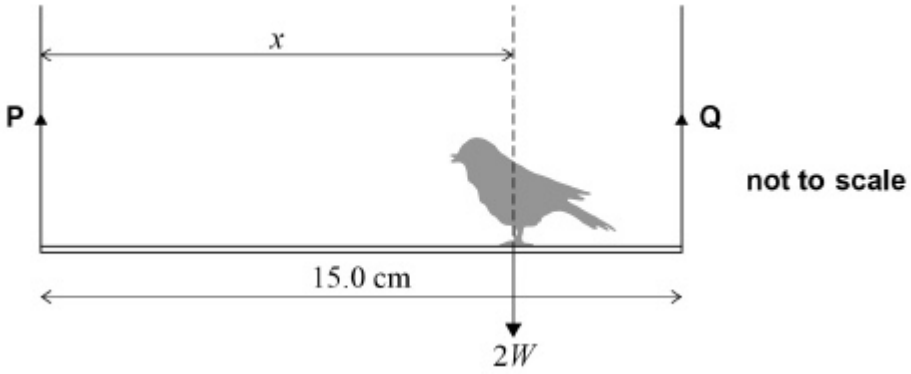
B 470 Hz ⬭

C 1400 Hz ⬭

D 2800 Hz ⬭

(Total 1 mark)

8 A bird sits on a uniform rod suspended from vertical wires **P** and **Q**.



not to scale

The rod has a weight W and is 15.0 cm long.
The weight of the bird is $2W$ and acts at a distance x from **P**.

What is the value of x when the tension in **P** is half the tension in **Q**?

A 7.50 cm ⬭

B 10.0 cm ⬭

C 11.3 cm ⬭

D 15.0 cm ⬭

(Total 1 mark)

9 The table contains information on four wires. It shows the stiffness of each wire and the maximum strain energy stored in the wire when extended to the breaking point.

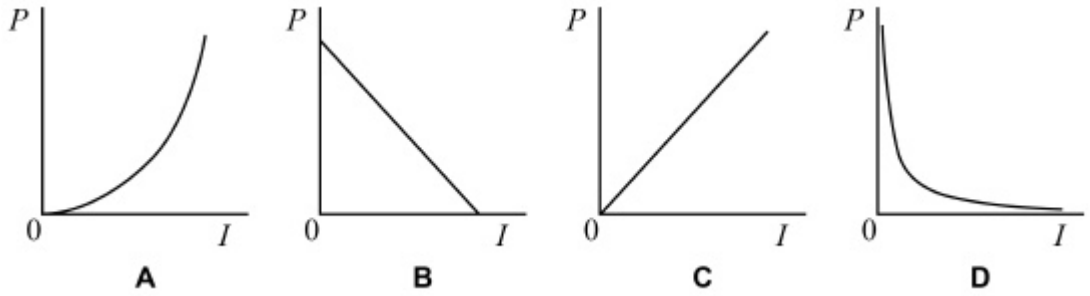
Assume each wire has the same initial dimensions and obeys Hooke's law.

Which wire extends the least before reaching the breaking point?

	Stiffness / N m^{-1}	Maximum strain energy / J	
A	4.0	1	⬭
B	9.0	1	⬭
C	16	3	⬭
D	25	3	⬭

(Total 1 mark)

10 Which graph shows how power dissipated P varies with current I in a component that obeys Ohm's law?



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

11 Which is equivalent to the ohm?

A J C^{-2} s^{-1} ⬭

B J C^{-2} s ⬭

C J s ⬭

D J s^{-1} ⬭

(Total 1 mark)

12 Two gamma photons are produced when a muon and an antimuon annihilate each other.

What is the minimum frequency of the gamma radiation that could be produced?

A 2.55×10^{16} Hz ⬭

B 5.10×10^{16} Hz ⬭

C 2.55×10^{22} Hz ⬭

D 5.10×10^{22} Hz ⬭

(Total 1 mark)

13 A gas containing doubly-charged ions flows to give an electric current of 0.64 A

How many ions pass a point in 1.0 minute?

A 2.0×10^{18} ⬭

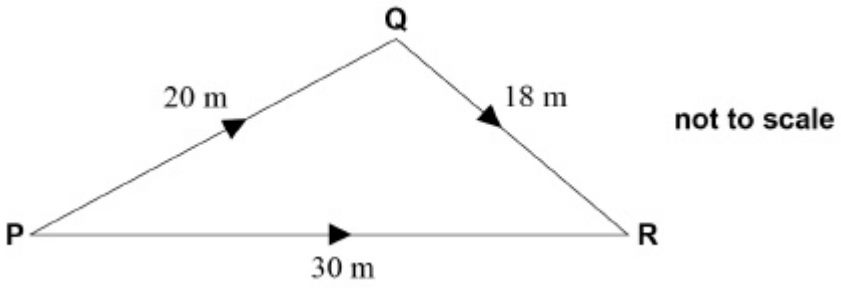
B 4.0×10^{18} ⬭

C 1.2×10^{20} ⬭

D 2.4×10^{20} ⬭

(Total 1 mark)

14 In the diagram, **P** is the source of a wave of frequency 50 Hz



The wave travels to **R** by two routes, **P** → **Q** → **R** and **P** → **R**. The speed of the wave is 30 m s−1

What is the path difference between the two waves at **R** in terms of the wavelength λ of the waves?

A 4.8λ ⬭

B 8.0λ ⬭

C 13.3λ ⬭

D 20.0λ ⬭

(Total 1 mark)

15 Three coplanar forces F_1, F_2 and F_3 act on a point object.

Which combination of forces can never produce a resultant force of zero?

	F_1 / N	F_2 / N	F_3 / N	
A	3	4	5	⬭
B	8	8	8	⬭
C	2	10	10	⬭
D	3	6	10	⬭

(Total 1 mark)