IB · DP · Physics

50 mins 6 questions

Practice Paper 2

Scan here to return to the course
or visit savemyexams.com

Total Marks /50

1 (a) Ric is standing in an elevator and has a mass of 68 kg. The elevator is moving upwards at a speed of 2.5 m s^{-1} and comes to rest 3.0 s later.

(a) Calculate the reaction force on Ric from the elevator floor during the time it takes the elevator to come to rest.

(4 marks)

(b) Ric realises that he forgot his lab coat on the floor below. He again travels in the elevator which goes downwards at the same speed, coming to rest in the same time.

(b) Calculate the reaction force on Ric from the elevator floor during the time it takes to come to rest at the floor below.

(3 marks)

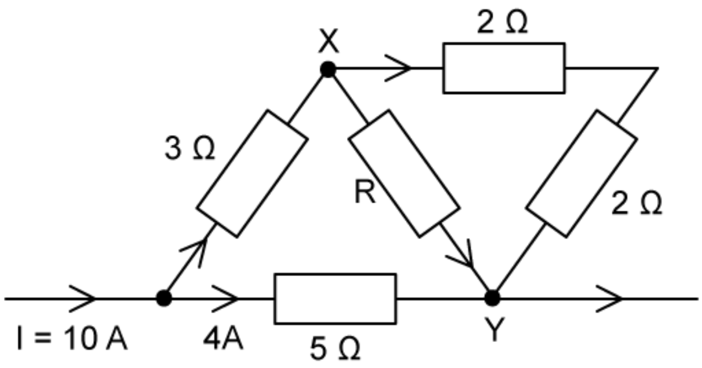
(c) Hence, deduce which deceleration period of the elevator would make Ric feel:

(i) Lighter

(ii) Heavier

(c) **(2 marks)**

2 (a) A current I = 10 A flows through a network of six resistors as shown.



The potential difference across the line XY is 8 V.

(a) Calculate the value of the unknown resistance *R*.

....

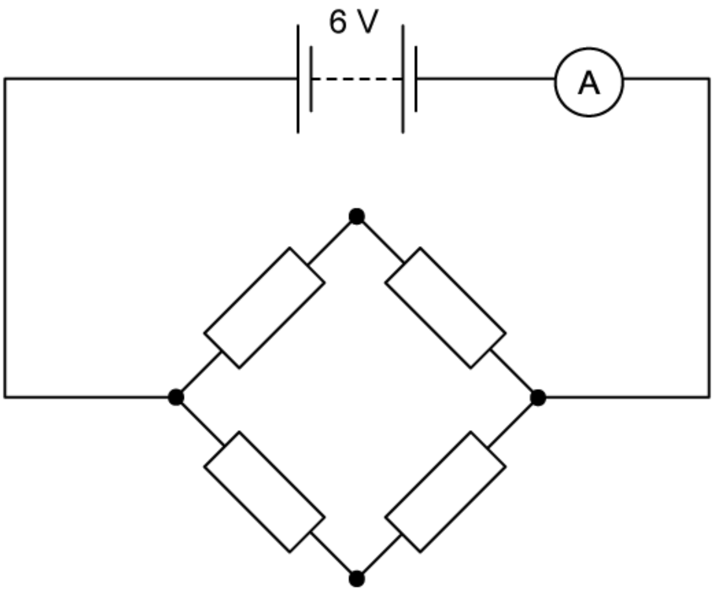
....

....

....

(4 marks)

(b) Another network, comprised of four identical resistors each of resistance 2 Ω, is connected to a 6 V battery with negligible internal resistance.



(b) Determine the reading on the ammeter.

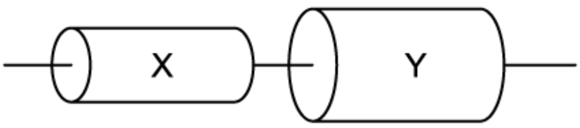
....

....

....

(3 marks)

(c) A resistor is made by connecting two uniform cylinders X and Y of the same material and equal in length, in series.



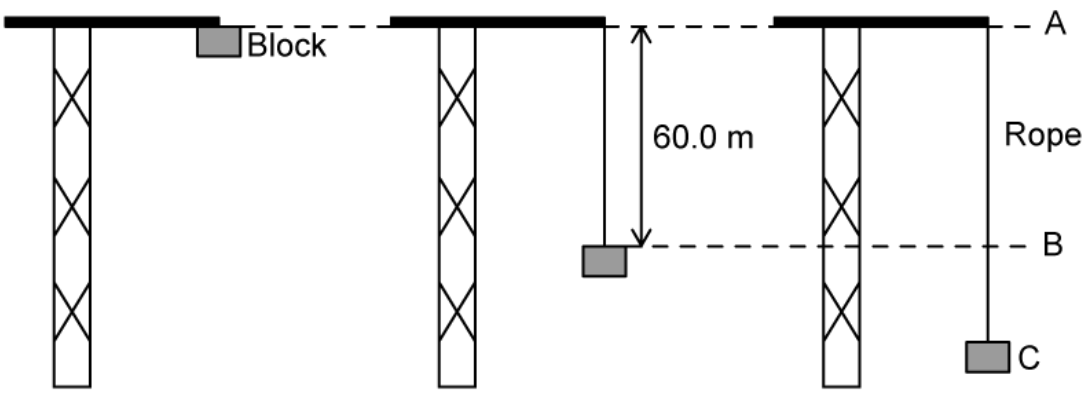
Cylinder Y has a resistance of 5 Ω and is twice the diameter of cylinder X.

(c) Calculate the total resistance of this series combination.

....

(1 mark)

3 (a) One end of an elastic climbing rope is fixed to the top of a crane. The other end of the rope is connected to a block which is initially at position A. The block is released from rest. The mass of the rope is negligible.



The full length of the rope is 60.0 m. From position A to B, the block falls freely.

(a)

(i) State the block's acceleration between position A and B.

[1]

(ii) Describe how the velocity of the block changes between position A and B.

[1]

....

....

(2 marks)

(b) (b) Calculate the speed of the block at position B.

[2]

....

....

(2 marks)

(c) (c) At position B the rope starts to extend. Position C is the point at which the rope is fully extended. Describe the motion of the block between position B and C.

[2]

....

(2 marks)

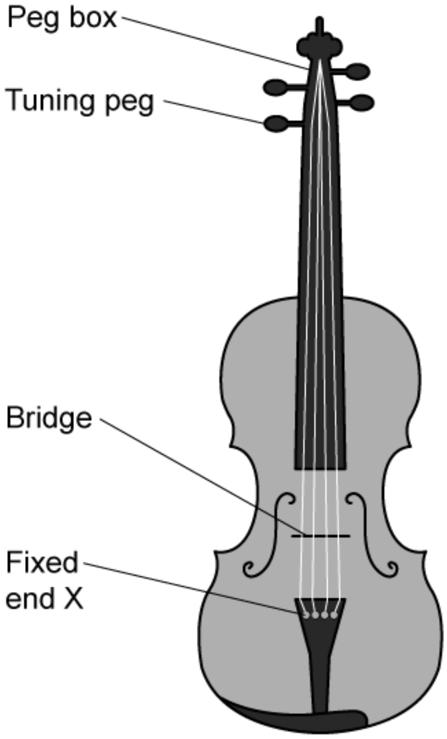
(d) Between position B and C the resultant force on the block changes, because the tension in the rope increases as the rope extends.

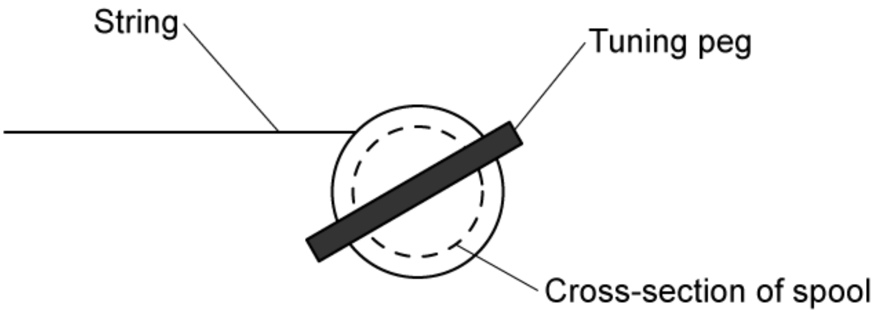
(d) State and explain whether a SUVAT equation can be used to determine the distance the block falls between position B and C.

[2]

(2 marks)

4 (a) The diagrams show the structure of a violin and a close-up of the tuning pegs.





The strings are attached at end X then pass over a bridge which acts as a fixed point. The strings are also fixed at the other end, where they are wound around cylindrical spools, fixed to tuning pegs.

Strings for musical instruments create notes according to their tension and a property of the string called mass per unit length, μ.

The properties of the string and the frequency of the first harmonic are related by the equation:

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

Where f = frequency of first harmonic (Hz), L = length (m), T = tension (N) and μ = mass per unit length (kg m^{-1}).

The mass of a particular string is 1.4×10^{-4} kg and it has a vibrating length of 0.35 m. When the tension in the string is 25 N, it vibrates with a first-harmonic frequency of 357 Hz.

(a) When the tension in the string is 50 N

(i) Calculate the mass per unit length, μ of the string.

[2]

(ii) Using the equation provided, calculate the speed at which waves travel along the string.

[3]

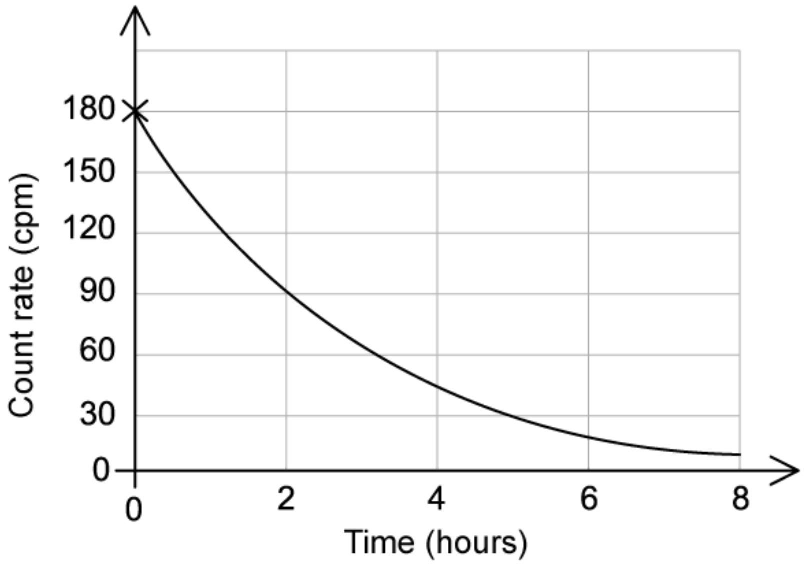
(5 marks)

(b) (b) Show that the first harmonic frequency doubles when the tension in the string quadruples.

[4]

(4 marks)

5 (a) A sample's count rate in counts per minute (cpm) is measured using a ray detector. This data is plotted on a graph.



(a)

(i) Use the graph to determine the half-life of this sample.

[2]

(ii) Explain why the distance between the detector and the source is a control variable.

[2]

(1 mark)

(b) The scientist wonders how the experiment in part (a) would have changed if the sample was twice the size.

(b) Assuming the experiment from part (a) was repeated with a sample the exact same age but twice the mass, calculate the length of time it would have taken to reach a count rate of 22.5 cpm.

(3 marks)

(c) (c) In reality the detector will measure a count rate of more than 5 cpm long after the length of time in part (b) has passed.

(i) Outline the reason for this larger-than-expected count rate.

[2]

(ii) Describe the measurements the scientist could take to accurately account for this additional count rate in the final data.

[2]

(4 marks)

6 (a) Thermal radiation is emitted by all bodies with an absolute temperature. It is often modelled using an idealised 'black body'.

(a) Explain how the temperature of a black body can be estimated based on the frequency of radiation emitted from it.

(2 marks)

(b) The spectrum of radiation emitted by a sample of glacier ice is examined. The ice is at a temperature of –55 °C.

(b) Calculate the peak wavelength of radiation emitted by the ice.

(2 marks)

(c) The average albedo of clean snow is 0.9. The average albedo of the glacier ice is 0.25.

(c) For the glacier:

(i) Determine the ratio of radiation scattered from the snow compared to the glacier ice

[2]

(ii) Outline an assumption made in part (i) and give a reason why this assumption may not be correct.

[2]

(4 marks)