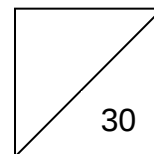




NORTH VISTA SECONDARY SCHOOL
Preliminary Examination 2024
Secondary 4 Normal Academic



CANDIDATE
NAME

CLASS

INDEX
NUMBER

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SCIENCE

5105/02

Paper 2 Physics

1 August 2024

Papers 1 and 2: 1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.
Write your answers in the spaces provided.

Section B

Answer **one** question.
Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than 30 minutes on Paper 1.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [] at the end of each question or part question.

Section A

Answer **all** the questions in the spaces provided.

- 1 (a) State the speed of infra-red radiation in a vacuum.

speed = m/s [1]

- (b) The wavelength of infra-red radiation is 920nm.

Calculate the frequency of these infra-red radiation.

frequency = Hz [2]

- (c) Name one region of the electromagnetic spectrum that contains waves with a longer wavelength than infra-red radiation. State one use of the region named.

name of region

use

..... [2]

[Total: 5]

- 2 A motorcycle and rider have a combined mass of 620kg. The motorcycle accelerates uniformly from rest to 28.0m/s in 3.50s.

Calculate

- (a) the acceleration of the motorcycle and rider,

average acceleration = m/s² [2]

- (b) the accelerating force.

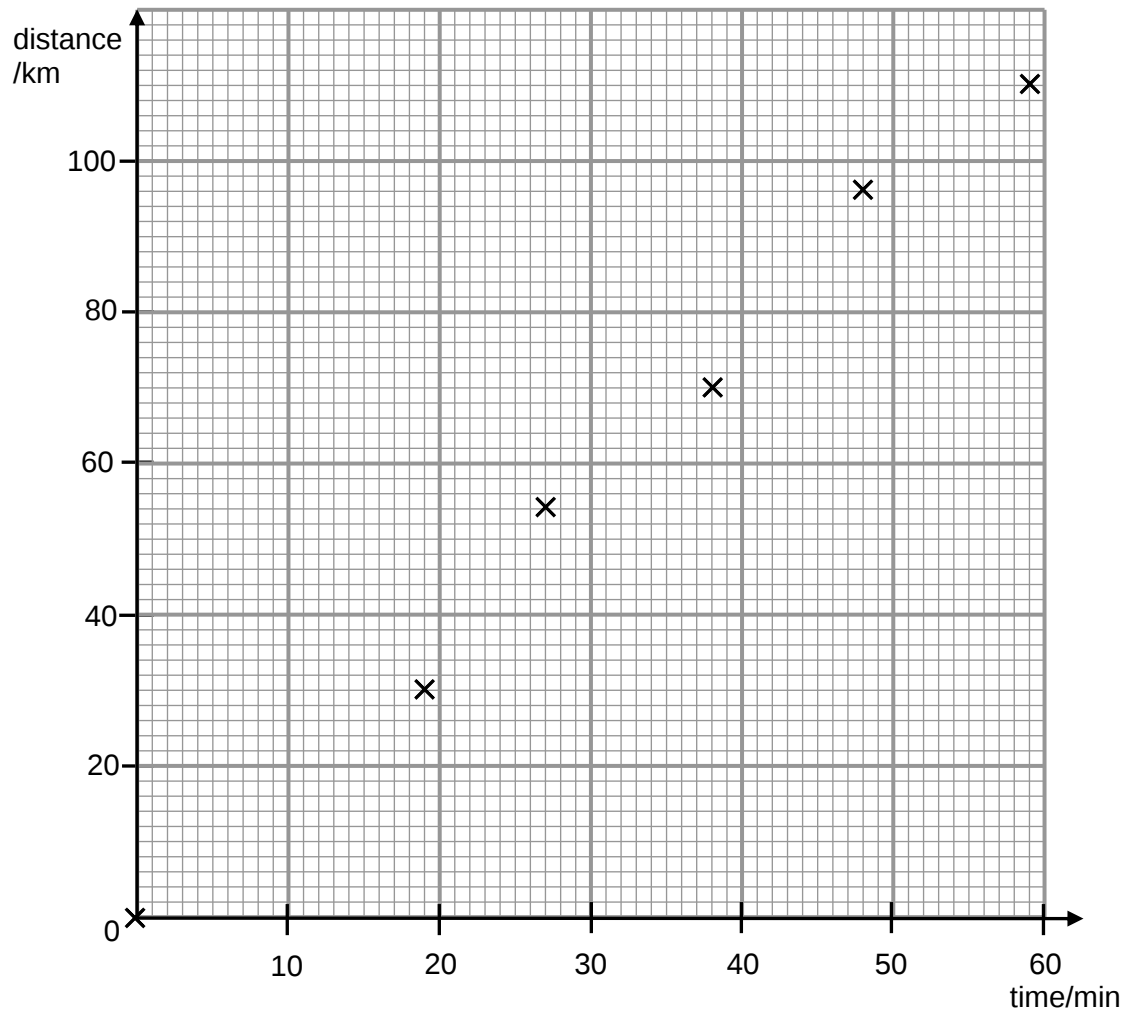
accelerating force = N [1]

[Total: 3]

- 3** A train service runs between two towns X and Y. The train's timing at different distances, each marked with a cross (x), are plotted on the distance-time graph.

(a) Plot a best-fit straight line using the points shown.

[1]



(b) From your graph, determine the gradient.

gradient = [2]

[Total: 3]

- 4 The table contains some statements. Some statements are true and some are false.

Complete the table by writing either **true** or **false** in each box.

statement	true/false
The SI unit for density is g/cm ³ .	
All electromagnetic waves are transverse waves.	
When water freezes into ice, the temperature remains unchanged because the internal potential energy remains unchanged.	
Metals are good conductors of heat because they have free electrons.	
Radiation does not occur in a vacuum.	
An electric appliance with double insulation does not require an Earth wire.	

[3]

[Total: 3]

- 5 (a) A black kettle is used to boil water and store hot water.



A student suggests that changing to a white kettle will make the hot water stay hot for a longer duration.

Do you agree? Explain your answer.

.....

 [2]

- (b) State what happens to the motion of the water molecules as the temperature of the water decreases.

.....
 [1]

- (c) The handle of the kettle is made of plastic.

Explain one advantage to the user of using a handle made of plastic.

.....
 [1]

[Total: 4]

- 6 Carbon-14 is a radioactive isotope of carbon with the nuclide notation $^{14}_6\text{C}$.

- (a) State what the number 14 represents in the symbol $^{14}_6\text{C}$.

..... [1]

- (b) When a nucleus of carbon-14 undergoes radioactive decay, it emits a β -particle.

- (i) State another name for a β -particle.

..... [1]

- (ii) A sample contains 100g of carbon-14 isotopes.

If it is expected to contain 25g of carbon-14 isotopes after 11 460 years, determine the half-life of the carbon-14 isotope.

half-life = years [2]

[Total: 4]

Section B

Answer **one** question from this section.

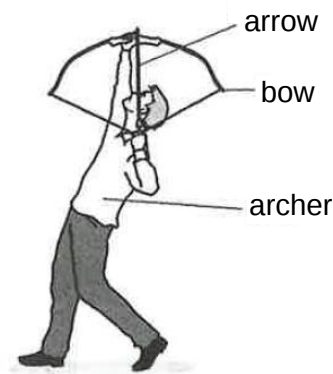
- 7 (a) Define *power*.

.....

.....

..... [1]

- (b) An archer fires an arrow vertically upwards.



The arrow has a mass of 0.20kg. The string of the bow is pulled back a distance of 0.70m. In doing so, the man does 105J of work.

The gravitational field strength, $g = 10\text{N/kg}$

Ignore any effects of friction.

- (i) Calculate the average force used in pulling back the string of the bow.

average force = N [2]

- (ii) State the energy in the kinetic store of the arrow as it leaves the bow.

energy in the kinetic store = J [1]

- (iii) Calculate the speed with which the arrow leaves the bow.

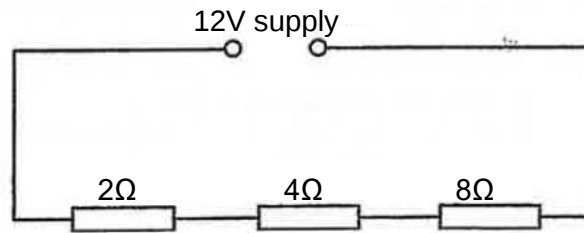
speed = m/s [2]

- (iv) Calculate the maximum height reached by the arrow.

maximum height = m [2]

[Total: 8]

- 8 (a) Three different resistors, 2Ω , 4Ω and 8Ω , are connected in series with a 12V supply.



- (i) State which resistor has the greatest potential difference across it.
 [1]

- (ii) Explain your answer in (a)(i).

 [2]

- (b) A student has some resistors, each of resistance 20Ω .

Draw a circuit diagram to show how 20Ω resistors may be connected to give a total resistance of 30Ω .

[1]

- (c) An electric heater has a power of 2.0kW .

- (i) An electric company charges $\$0.25$ per kWh used.

Calculate the cost of using the electric heater for 2.5 hours.

cost = $\$$ [1]

- (ii) The 2.0kW heater is connected to a 240V supply.

Calculate the current flowing through the electric heater.

current = A [2]

- (iii) There is a choice of 1A, 3A, 5A, 10A and 13A fuses.

State which fuse should be placed in the plug that is fitted to the electric heater.

Explain your choice of fuse.

fuse

explanation

..... [1]

[Total: 8]

End of Paper