EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level
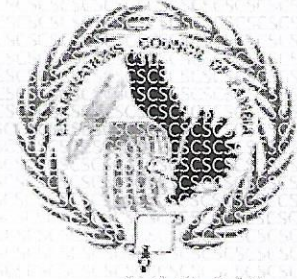
Science

5124/1

Paper 1

2020

Additional materials

Electronic calculator (non programmable)
Graph paper
Soft clean eraser
Soft pencil (type B or HB is recommended)

Time: 2 hours   **Marks: 85**

Instructions to Candidates

1 Write the **centre number** and your **examination number** on every page of this question paper and on the separate Answer Booklet/paper provided.

2 There are **three (3)** sections in this paper.

(i) Section A

There are **twenty (20)** questions in this section. Answer all questions.
For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and record your choice by marking it with a cross (X) on the **answer grid provided** on the question paper.

(ii) Section B

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

(iii) Section C

Answer any **two** questions. Write your answers on a separate **Answer Booklet/Paper provided**.

Candidate's Use		Examiner's Use
Section A		
Section B		
Section C	1	
	2	
	3	
Total		

Information for candidates

1 Any rough working should be done in this question paper.

2 **At the end of the examination:**

(i) Fasten the separate answer booklet/papers used securely to the question paper.

(ii) Circle the numbers of the section **C** questions you have answered in the grid below.

3 **Cell phones are not allowed in the examination room.**

Centre Number	Examination Number

ANSWER GRID FOR SECTION A

Put a cross (X) on the letter indicating your choice of answer.

1	A	B	C	D

11	A	B	C	D

2	A	B	C	D

12	A	B	C	D

3	A	B	C	D

13	A	B	C	D

4	A	B	C	D

14	A	B	C	D

5	A	B	C	D

15	A	B	C	D

6	A	B	C	D

16	A	B	C	D

7	A	B	C	D

17	A	B	C	D

8	A	B	C	D

18	A	B	C	D

9	A	B	C	D

19	A	B	C	D

10	A	B	C	D

20	A	B	C	D

SECTION A

Answer **all** the questions on the answer grid provided.

A1   How many significant figures are in 2.0800?

     A   2

     B   3

     C   4

     D   5

A2   Which of the following contains base physical quantities only?

     A   Length in kilometres, mass in tonnes

     B   Length in metres, mass in tonnes

     C   Length in kilometres, mass in kilograms

     D   Length in metres, mass in kilograms

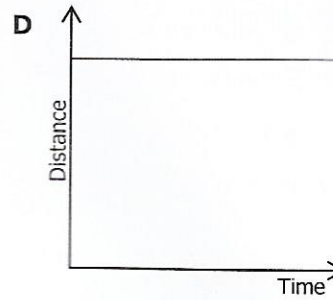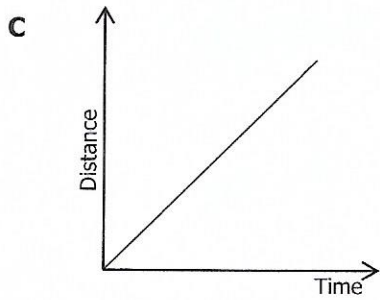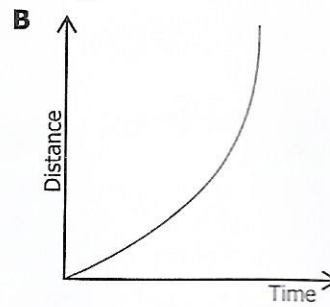A3   The following diagrams show steps that a learner carried out in order to determine the volume of a wooden cork.
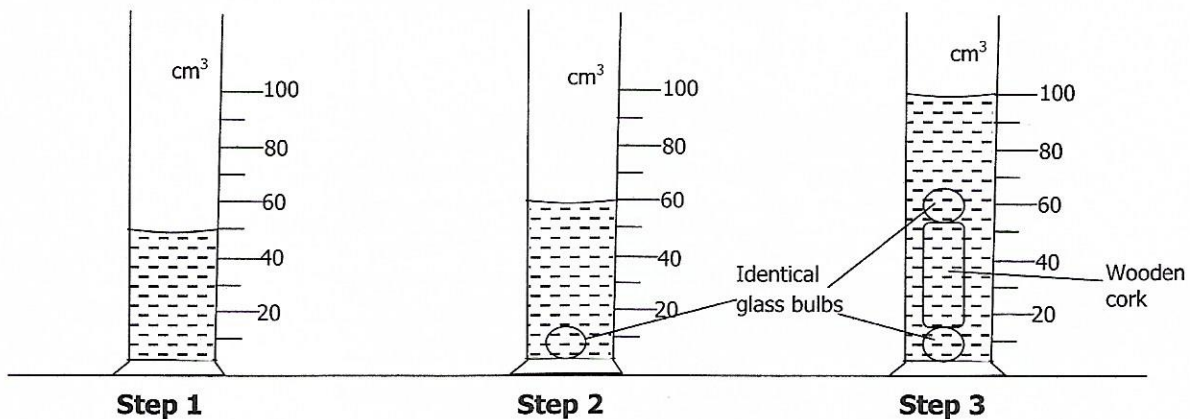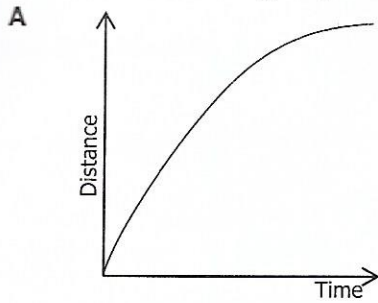

Which one is the volume of the wooden cork?

     A $30cm^3$

     B $40cm^3$

     C $50cm^3$

     D $100cm^3$

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A4 Which of the following diagrams show an accelerating car?

A

B

C

D

A5 The diagram below shows a light bar **PR** pivoted at **P**, balanced by a 4N weight and force **F**.
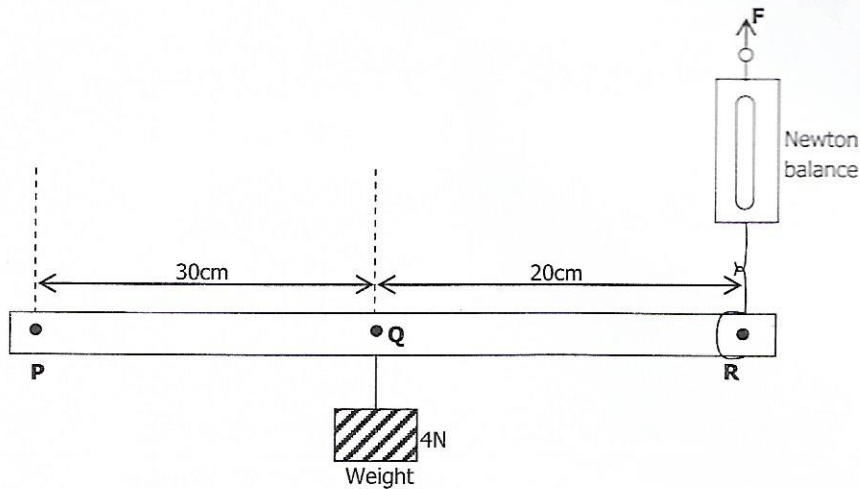
What is the reading on the Newton balance?

A   2.0N

B   2.4N

C   3.0N

D   6.0N

A6 A car is travelling on a level road. Suddenly the driver of the car sees a cow crossing the road and decides to apply brakes. What are the energy changes as the car slows down?

A   Chemical to kinetic and sound

B   Heat to kinetic and sound

C   Kinetic to chemical and sound

D   Kinetic to heat and sound
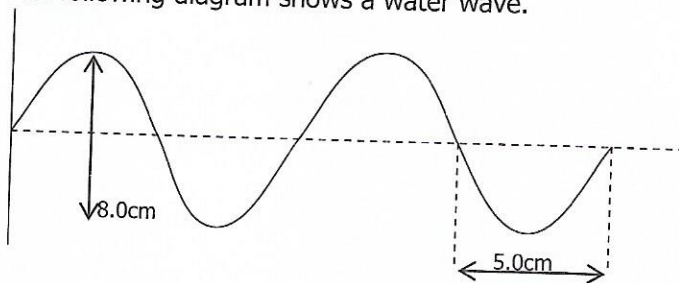
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A7 The graph below shows a cooling curve of a gaseous substance.
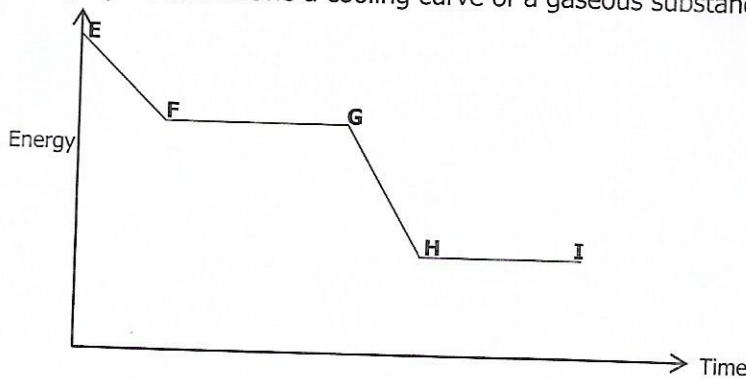
In which state(s) of matter will the substance be between point **F** and **G**?

A   Gas only

B   Liquid only

C   Gas and liquid

D   Solid and liquid

A8 The following diagram shows a water wave.

Which row gives the correct values for the wave amplitude and wavelength?

	Amplitude/cm	Wavelength/cm
A	4.0	10
B	4.0	5.0
C	8.0	5.0
D	8.0	10

A9 The diagram below shows a learner in front of a loudspeaker that produces sound.
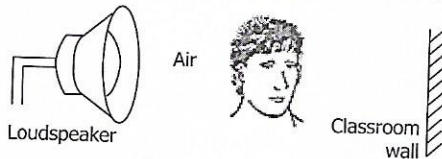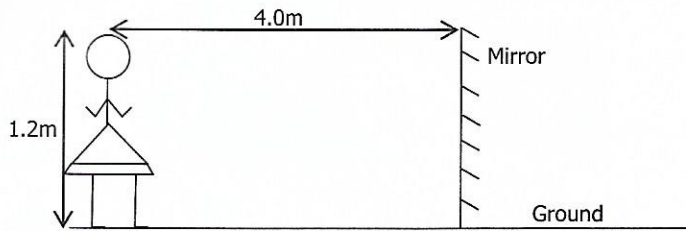

Which of the following diagrams best shows how the gaseous air molecules between the learner and the loudspeaker will move?

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A10 A girl of height 1.2 metres stands 4.0 metres in front of a plane mirror as shown in the following diagram:

How far is the girl away from her image?

    A   1.2m
    B   2.4m
    C   4.0m
    D   8.0m

A11 A line **JK** drawn on a piece of plain paper on which a glass block is placed was viewed through the top and its image was located using a pin as shown in the following diagram.
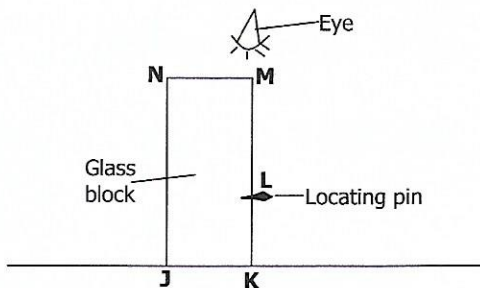
If **KL** = 1.8cm and **KM** = 4.8cm, what is the refractive index of the glass?

    A   0.63
    B   1.50
    C   1.60
    D   2.66

A12 Which of the following materials would be most suitable for constructing the core of an electromagnet?

    A   Carbon
    B   Copper
    C   Iron
    D   Steel

A13 Two uncharged metal spheres **Q** and **P** are placed on insulating stands and are separated while the negatively charged polythene strip is held near **Q** as shown in the diagram.
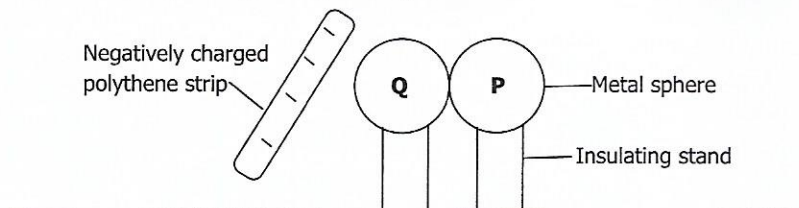
What would be the charges on **Q** and **P**?

	Q	P
A	+	+
B	+	−
C	−	+
D	−	−

A14 The following diagram shows a network of 3 resistors R_1, R_2 and R_3 connected to a battery. Voltmeters V_1, V_2 and V_3 are connected to R_1, R_2 and R_3 respectively.
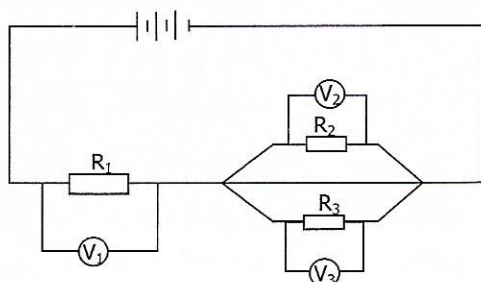

Which of the following expressions show the potential difference (p.d.) supplied by the battery?

A $V_1 + V_3$
B $V_2 + V_3$
C $V_1 + V_2 + V_3$
D $V_1 - (V_2 + V_3)$

A15 An electric kettle is rated '230V, 3 000W'. What is the suitable fuse to use on this kettle?

A 2A
B 5A
C 10A
D 15A

A16 Below are 3 statements on electromagnetism.

1. An electromagnet consists of a coil of wire wound on a soft iron core.

2. The strength of the magnetic field produced by an electromagnet increases if the strength of the current and/or number of turns of wire is increased.

3. In the diagram below, when the switch is closed, the gap, **R**, increases.
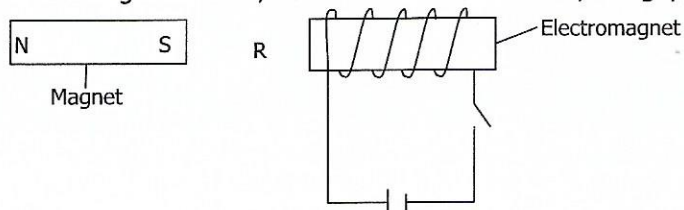
Which of the above statements are true?

A 1 and 2
B 2 and 3
C 1 and 3
D 1, 2 and 3

A17   The diagram below shows a filament lamp rated 6.0V connected to the output of a transformer.
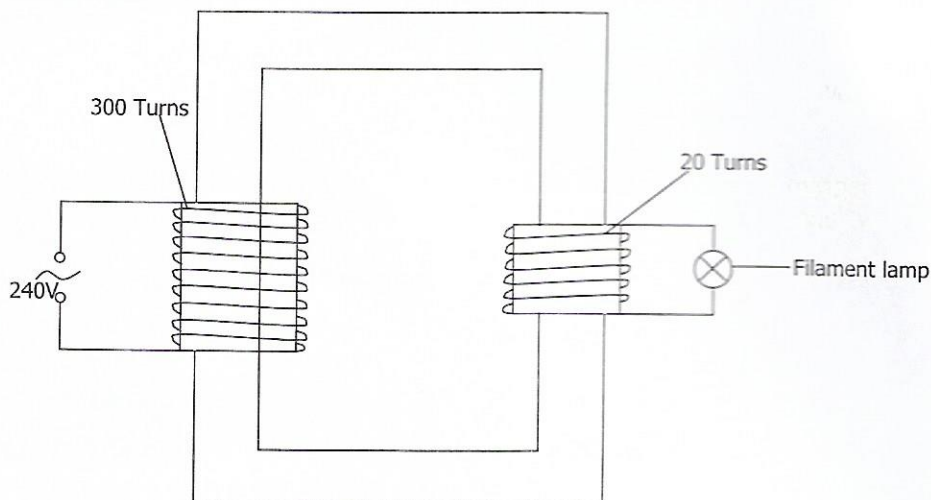
What happens to the lamp when the circuit is switched on?

A   Lights dimly
B   Does not light at all
C   Lights at normal brightness
D   Lights up brightly and then blows off

A18   Which component used in electronic circuits allows current to flow through in one direction only?

A   Diode
B   Resistor
C   Thermistor
D   Transformer

A19   An atom of uranium-235 has 92 electrons. How many protons are there in one atom of uranium-235?

A   92
B   143
C   235
D   327

A20   A radioactive material gives a count rate of 8 000 counts per minute. After 20 days it gives a count rate of 500 counts per minute. What is the half-life of the material?

A   4 days
B   5 days
C   20 days
D   50 days

Section B   [45 marks]
Answer **all** questions in this section.
Write your answers in the spaces provided on the question paper.

B1   **Figure B1.1** below shows a simple pendulum suspended from a fixed point.
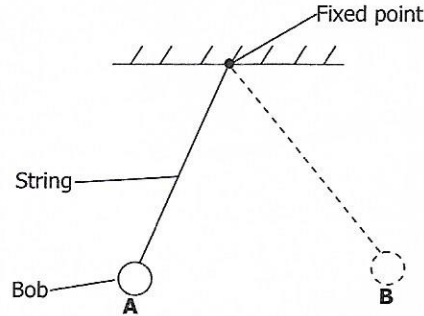
Figure B1.1

The bob is slightly pulled to position **A** and then released.

(a)   State **one** factor that does **not** affect the period of the pendulum.

.... [1]

(b)   If the values of time for 20 oscillations obtained were

16.1s, 15.9s, 16.0s, 16.2s and 15.8s, calculate the period of the pendulum.

Period of pendulum = ... [3]

(c)   Calculate the frequency of the pendulum.

Frequency = ... [2]

[Total: 6 marks]

[Turnover

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B2   A car has a mass of 900kg. It accelerates from rest at a rate of 1.2m/s^2.

Calculate the

(i) time taken to reach a velocity of 30m/s,

Time = ...   [2]

(ii) force required to accelerate the car at a rate of 1.2m/s^2.

Force = ...   [2]

[Total: 4 marks]

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B3 **Figure B3.1** below is a diagram showing a load being moved using a wheelbarrow.
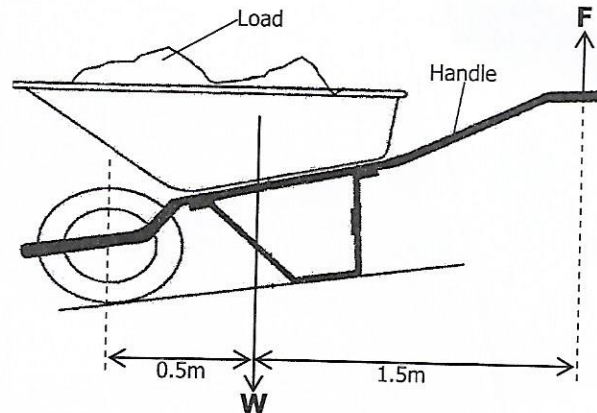
Figure B3.1

The total mass of the wheelbarrow and the load is 80kg. (Take g = 10N/kg)

(a) Calculate the

    (i) weight of the wheelbarrow and the load,

Weight = ... [2]

    (ii) force, **F**, required to lift the wheelbarrow.

Force = ... [2]

(b) State whether force, **F**, would increase or reduce when the handles of the wheelbarrow are made longer.

.... [1]

[Total: 5 marks]

[Turnover

Centre Number	Examination Number

B4   **Figure B4.1** below is a diagram showing a stone of mass 2kg that was pushed up a slope from **Q** to **R**.
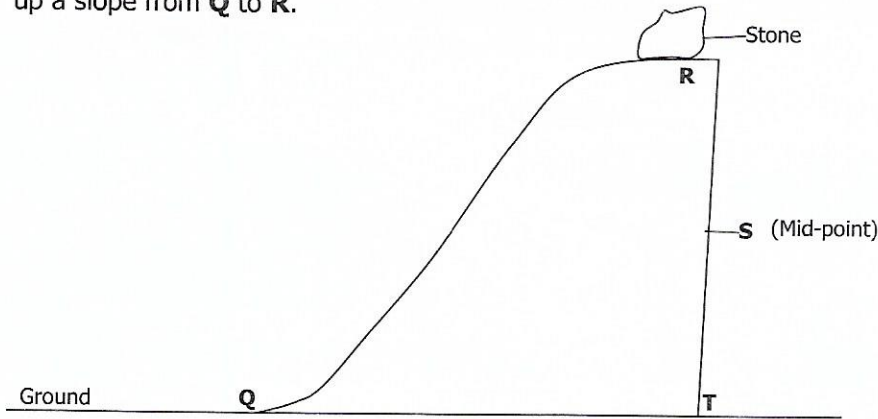
Figure B4.1

72 joules of work was done in moving the stone up the slope from **Q** to **R**.

(a)   What is the potential energy of the stone at **R**?

....   [1]

(b)   If the stone falls through side **RT**, what would its potential energy be at **S**, the mid-point of its fall?

Potential energy = ...   [1]

(c)   Calculate the
        (i)   height **TR**,

Height = ...   [2]

(ii)   velocity of the stone just before it strikes the ground.

Velocity = ...   [2]

[Total: 6 marks]

B5 **Figure B5.1** below is a diagram showing a wave travelling along a spring in the direction shown.

→ Wave direction

U   W

Figure B5.1

(a) In what way is this wave the same as a sound wave?

....

.... [1]

(b) What are regions **U** and **W** called?

(i) **U** .... [1]

(ii) **W** .... [1]

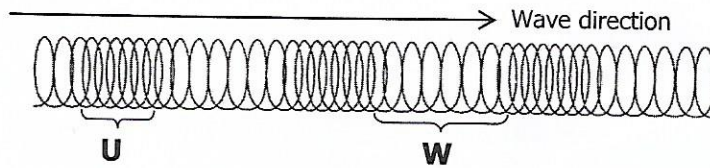(c) Explain why sound waves travel faster in liquids than in gases.

....

....

.... [2]

[Total: 5 marks]

B6 A ray of light travels from air into water at an angle of 40° between the normal and the incident ray.

If this ray produces an angle of refraction of 29°, calculate

(i) the refractive index of water,

Refractive index= .... [2]

(ii) the critical angle of water.

Critical angle = ... [2]

[Total: 4 marks]

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[Turnover

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B7 **Figure B7.1** is a diagram showing a 240V mains supply connected to a television set and two lamps.
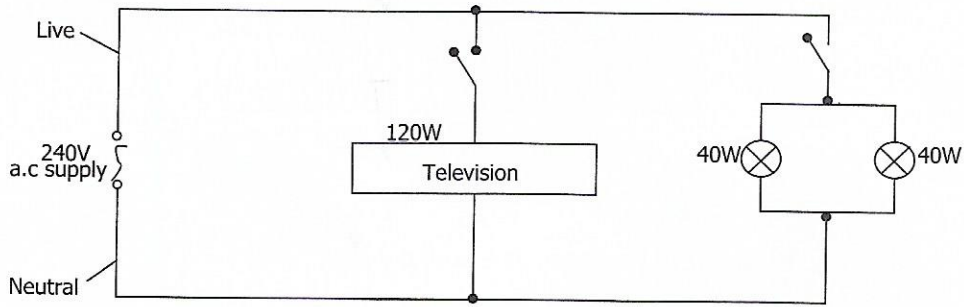
Figure B7.1

The power supplied to each lamp and television is 40W and 120W respectively, when the switches are closed.

(a) Calculate the

(i) total power supplied,

Power = ... [2]

(ii) total number of kilowatt hours (kWh) of energy supplied to the circuit in 3.0 hours,

Energy = ... [2]

(iii) p.d. across the television set.

P.d = ... [2]

[Total: 6 marks]

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B8 **Figure B8.1** is a diagram showing a coil of wire wound on a soft iron core, with current flowing in the direction indicated by the arrows.
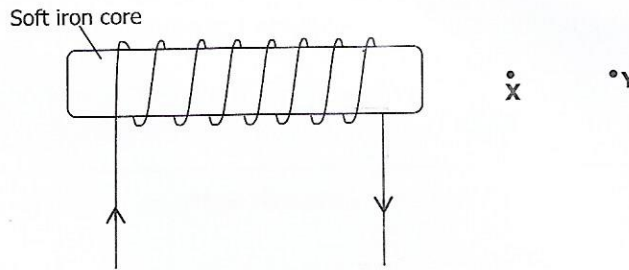

Figure B8.1

(a) Mark the **N** and **S** poles induced on the iron core. [1]

(b) Show by an arrow the direction in which a plotting compass needle would point when placed at point **X**. [1]

(c) A beam of electrons flows through point **Y** in a direction perpendicularly downwards into the paper. Show clearly using an arrow labelled **F**, the direction of the force exerted by the magnetic field on the electron beam. [1]

[Total: 3 marks]

B9 Phosphorus–32 (P–32) can decay by emitting beta particles.

(a) What is a beta particle?

.... [1]

(b) If the proton number of phosphorus–32 is 15,

(i) state the new values of proton and mass numbers of the nuclide just after it emits a beta particle,

Proton Number: .... [1]

Mass Number: .... [1]

(ii) write the decay equation for P–32 after emitting two beta particles.

[2]

(c) Phosphorus–32 can be used to prove that plants absorb phosphorus nutrient from the soil around them. State **one** safety precaution which should be taken into consideration when doing experiments with phosphorus–32.

....

.... [1]

[Total: 6 marks]

[Turnover

SECTION C   [20 marks]

Answer any **two (2)** questions from this section in the separate Answer Booklet provided.

C1   **Figure C1.1** below is a velocity time graph representing motion of a motor cycle travelling along a straight road.
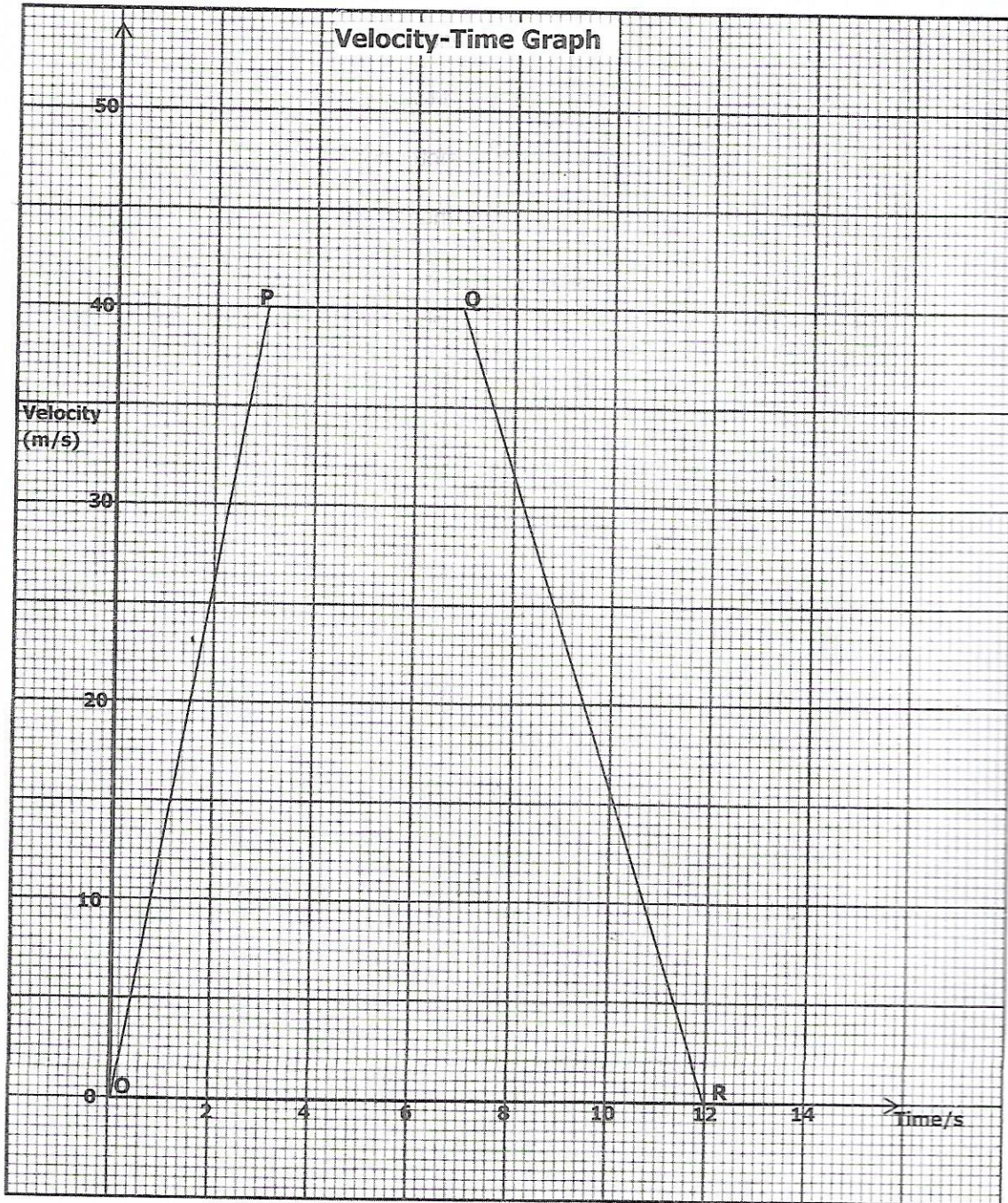

Figure C1.1

(a) Describe the motion of the motor cycle between the points

      (i)   **O** and **P**,

      (ii)   **P** and **Q**,

      (iii)   **Q** and **R**.   [3]

(b) What is the maximum speed of the motor cycle?   [1]

(c) How long did it take the motor cycle to retard to rest?   [1]

(d) Calculate the total distance travelled by the motor cycle.   [3]

(e) Calculate the average velocity for the whole motion.   [2]

[Total: 10 Marks]

C2   A learner carried out a Hooke's Law experiment and obtained the following results:

Table C2.1

Mass/kg	0	0.02	0.04	0.06	0.08	0.10
Length of loaded spring/cm	11	12.1	13.2	14.3	15.4	16.5
Applied force/N						
Extension/mm						

(a) Copy and complete **table C2.1** by finding values of applied force (N) and extension (mm) produced.   [2]

(b) Plot a graph of applied force (N) against extension (mm).   [4]

(c) From the graph determine the spring constant.   [2]

(d)   **(i)**   Did the spring reach its elastic limit?   [1]

      (ii)   Explain your answer in **(d)(i)** above.   [1]

[Total: 10 Marks]

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C3   Figure C3.1 is a chart showing some components of the electromagnetic spectrum.

			Blue	Green		Microwaves	

Figure C3.1

(a)   (i)   Use the list below to copy and complete the electromagnetic spectrum chart.
       Radio waves, x-rays, ultraviolet, gamma rays, infra-red and red light   [2]

       (ii)   State **two** properties common to all members of the
              electromagnetic spectrum.   [2]

(b)   Name a component of the spectrum that

       (i)   has the longest wavelength,

       (ii)   is emitted by hot bodies.   [2]

(c)   Microwaves have a frequency of 10^{10}Hz and velocity of 3×10^{8}m/s.

       (i)   Calculate the wavelength of microwaves.   [2]

       (ii)   State **two** practical uses of microwaves.   [2]

[Total: 10 Marks]