Government of South Australia

SACE Board of SA

External Examination 2010

2010 PHYSICS

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

QUESTION BOOKLET

1

23 pages, 14 questions

Tuesday 2 November: 9 a.m.

Time: 3 hours

Part 1 of Section A

Examination material: Question Booklet 1 (23 pages)
Question Booklet 2 (21 pages)
Question Booklet 3 (8 pages)
one SACE registration number label

Approved dictionaries and calculators may be used.

Instructions to Students

1. You will have 10 minutes to read the paper. You must not write in your question booklets or use a calculator during this reading time but you may make notes on the scribbling paper provided.

2. This paper is in two sections: Section A is divided between Question Booklet 1 and Question Booklet 2; Section B is divided between Question Booklet 2 and Question Booklet 3.

   Section A (Questions 1 to 24)
   This section consists of short-answer and extended questions.
   Answer Part 1 of Section A (Questions 1 to 14) in the spaces provided in Question Booklet 1.
   Write on page 23 of Question Booklet 1 if you need more space to finish your answers.
   Answer Part 2 of Section A (Questions 15 to 24) in the spaces provided in Question Booklet 2.
   Write on page 21 of Question Booklet 2 if you need more space to finish your answers.

   Section B (Questions 25 to 27)
   This section consists of one experimental skills question and two extended-response questions.
   Answer Part 1 of Section B (Question 25) in the spaces provided in Question Booklet 2.
   Write on page 21 of Question Booklet 2 if you need more space to finish your answers.
   Answer Part 2 of Section B (Questions 26 and 27) in the spaces provided in Question Booklet 3.
   Write on page 8 of Question Booklet 3 if you need more space to finish your answers.

3. The allocation of marks and the suggested allotment of time are:

Section A	Part 1	74 marks	74 minutes
	Part 2	56 marks	56 minutes
Section B	Part 1	20 marks	15 minutes
	Part 2	30 marks	35 minutes
Total		180 marks	180 minutes

4. The equation sheet is on pages 3 and 4, which you may remove from this booklet.

5. Vector quantities in this paper are indicated by arrows over the symbols.

6. Marks may be deducted if you do not clearly show all steps in the solution of problems, if you give answers with an inappropriate number of significant figures or with incorrect units, or if you do not define additional symbols. You should use diagrams where appropriate in your answers.

7. Use only black or blue pens for all work other than graphs and diagrams, for which you may use a sharp dark pencil.

8. Attach your SACE registration number label to the box at the top of this page. Copy the information from your SACE registration number label into the boxes on the front covers of Question Booklet 2 and Question Booklet 3.

9. At the end of the examination, place Question Booklet 2 and Question Booklet 3 inside the back cover of this question booklet.

STUDENT'S DECLARATION ON THE USE OF CALCULATORS

By signing the examination attendance roll I declare that:

- my calculators have been cleared of all memory;
- no external storage media are in use on these calculators.

I understand that if I do not comply with the above conditions for the use of calculators I will:

- be in breach of the rules;
- have my marks for the examination cancelled or amended;
- be liable to such further penalty, whether by exclusion from future examinations or otherwise, as the SACE Board of South Australia determines.

Remove this page from the booklet by tearing along the perforations and keep the information in front of you for reference.

EQUATION SHEET

The following tables show the symbols of common quantities and the magnitude of physical constants used in the equations. Other symbols used are shown next to the equations. Vectors are indicated by arrows. If only the magnitude of a vector quantity is used, the arrow is not used.

Symbols of Common Quantities

acceleration	$\vec{a}$	wavelength	λ	momentum	$\vec{p}$
time	t	force	$\vec{F}$	electric field	$\vec{E}$
displacement	$\vec{s}$	charge	q	kinetic energy	K
velocity	$\vec{v}$	mass	m	magnetic field	$\vec{B}$
period	T	potential difference	ΔV	electric current	I
frequency	f	work done	W		

Magnitude of Physical Constants

Acceleration due to gravity at the Earth's surface	$g = 9.8 \text{ m s}^{-2}$	Charge of the electron	$e = 1.60 \times 10^{-19}$ C
Constant of universal gravitation	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$	Mass of the electron	$m_e = 9.11 \times 10^{-31}$ kg
Speed of light in a vacuum	$c = 3.00 \times 10^8 \text{ m s}^{-1}$	Mass of the proton	$m_p = 1.673 \times 10^{-27}$ kg
Coulomb's law constant	$\frac{1}{4\pi\varepsilon_0} = 9.00 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$	Mass of the neutron	$m_n = 1.675 \times 10^{-27}$ kg
Planck's constant	$h = 6.63 \times 10^{-34}$ J s	Mass of the α particle	$m_\alpha = 6.645 \times 10^{-27}$ kg

Section 1: Motion in Two Dimensions

$\vec{v} = \vec{v}_0 + \vec{a}t$ — $\vec{v}$ = velocity at time t; $\vec{v}_0$ = velocity at $t = 0$

$v^2 = v_0^2 + 2as$

$\vec{s} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$

$v_H = v \cos\theta$ — θ = angle to horizontal

$v_v = v \sin\theta$

$v = \dfrac{2\pi r}{T}$ — r = radius of circle

$\Delta\vec{v} = \vec{v}_f - \vec{v}_i$ — $\vec{v}_f$ = final velocity; $\vec{v}_i$ = initial velocity

$\vec{a}_{\text{ave}} = \dfrac{\Delta\vec{v}}{\Delta t}$ — $\vec{a}_{\text{ave}}$ = average acceleration

$a = \dfrac{v^2}{r}$

$\tan\theta = \dfrac{v^2}{rg}$ — θ = banking angle

$F = G\dfrac{m_1 m_2}{r^2}$ — r = distance between masses m_1 and m_2

$v = \sqrt{\dfrac{GM}{r}}$ — M = mass of object orbited by satellite; r = radius of orbit

$\vec{F} = m\vec{a}$

$\vec{p} = m\vec{v}$

$\vec{F} = \dfrac{\Delta\vec{p}}{\Delta t}$

$K = \frac{1}{2}mv^2$

$W = Fs\cos\theta$ — θ = angle between force $\vec{F}$ and displacement $\vec{s}$

Section 2: Electricity and Magnetism

$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$ r = distance between charges q_1 and q_2

$\vec{E} = \frac{\vec{F}}{q}$

$E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

$W = q\Delta V$

$E = \frac{\Delta V}{d}$ d = distance between parallel plates

$F = I\Delta lB \sin\theta$ θ = angle between field $\vec{B}$ and current element $I\Delta\vec{l}$

$F = qvB \sin\theta$ θ = angle between field $\vec{B}$ and velocity $\vec{v}$

$r = \frac{mv}{qB}$ r = radius of circle

$T = \frac{2\pi m}{qB}$

$K = \frac{q^2 B^2 r^2}{2m}$

Section 3: Light and Matter

$v = f\lambda$ v = speed of light

$d \sin\theta = m\lambda$ d = distance between slits
θ = angular position of mth maximum
m = integer (0, 1, 2, . . .)

$\Delta y = \frac{\lambda L}{d}$ Δy = distance between adjacent minima or maxima
L = slit-to-screen distance

$d = \frac{1}{N}$ N = number of slits per metre of grating

$E = hf$ E = energy of photon

$p = \frac{h}{\lambda}$

$K_{max} = hf - W$ W = work function of the metal

$W = hf_0$ f_0 = threshold frequency

$f_{max} = \frac{e\Delta V}{h}$ ΔV = potential difference across the tube

Section 4: Atoms and Nuclei

$E_n - E_m = hf$ $E_n - E_m$ = energy difference

$A = Z + N$ A = mass number
Z = atomic number
N = number of neutrons

$E = mc^2$ E = energy

TABLE OF PREFIXES

Refer to the following table when answering questions that involve the conversion of units:

Prefix	Symbol	Value
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
centi	c	10^{-2}
milli	m	10^{-3}
micro	µ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

SACE BOARD OF SOUTH AUSTRALIA

SECTION A

Part 1 (Questions 1 to 14)

(74 marks)

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

1. A projectile is launched from ground height with an initial velocity of $16.0\,m\,s^{-1}$ at an angle of 40.0° above the horizontal, as shown in the diagram below. *Ignore the effects of air resistance*.

(a) Show that the magnitude of the horizontal component of the initial velocity is $12.3\,m\,s^{-1}$ and the magnitude of the vertical component of the initial velocity is $10.3\,m\,s^{-1}$.

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____ (3 marks)

(b) The time of flight of the projectile is 2.10 s.

Calculate the range of the projectile.

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____ (2 marks)

(c) (i) Calculate the vertical component of the velocity at time $t = 2.00$ s.

(3 marks)

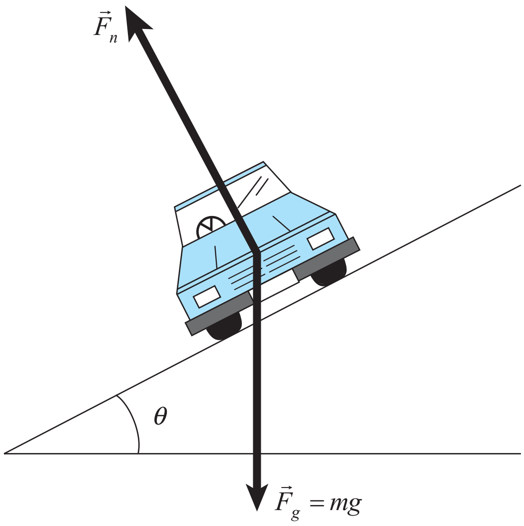
(ii) *Using a labelled vector diagram*, calculate the resultant speed of the projectile at $t = 2.00$ s.

(4 marks)

PLEASE TURN OVER

2. (a) The movement of a car in a circular path on a flat horizontal road relies on the friction between the road and the tyres to provide the centripetal acceleration. One component of the normal force on a car moving with uniform circular motion round a banked curve is directed towards the centre of the circle, thus reducing the reliance on friction.

(i) On the diagram below, draw vectors to show the horizontal component $\left(\vec{F}_h\right)$ and the vertical component $\left(\vec{F}_v\right)$ of the normal force $\left(\vec{F}_n\right)$ on a car moving with uniform circular motion round a banked curve.



[*This diagram is not drawn to scale.*]

(2 marks)

(ii) Show that the magnitude of the horizontal component (F_h) of the normal force is given by $F_h = mg\tan\theta$.

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____ (3 marks)

(b) A bobsled team competing in the Winter Olympics travels on a track that has banked curves, as shown in the photograph below:

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http://news.cnet.com/2300-10797_3-10002631-6.htm?tag=mncol.

Source: http://news.cnet.com

The bobsled team is travelling round a curve that has a radius of 105 m and a banking angle of 53°. The mass of the bobsled team (including sled) is 595 kg.

The centripetal acceleration is provided by the horizontal component $\left(\vec{F}_h\right)$ of the normal force on the bobsled team.

(i) Using the relationship from part (a)(ii), calculate the magnitude of the horizontal component $\left(F_h\right)$ of the normal force on the bobsled team.

(2 marks)

(ii) Determine the speed at which the bobsled team can travel round this banked curve without reliance on friction.

(3 marks)

3. (a) Explain why a geostationary satellite must orbit in a west-to-east direction.

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______________________________________ (2 marks)

(b) Explain one advantage of launching equatorial-orbit satellites in a west-to-east direction.

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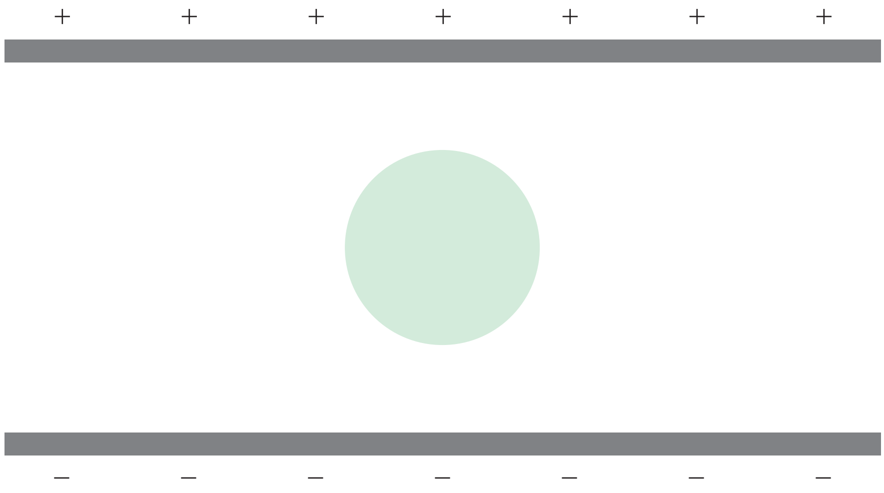
______________________________________ (2 marks)

4. The diagram below shows two isolated, spherically symmetric objects. The mass of Object A is much larger than the mass of Object B.

On the diagram above, draw vectors to show the gravitational forces that these objects exert on each other. (2 marks)

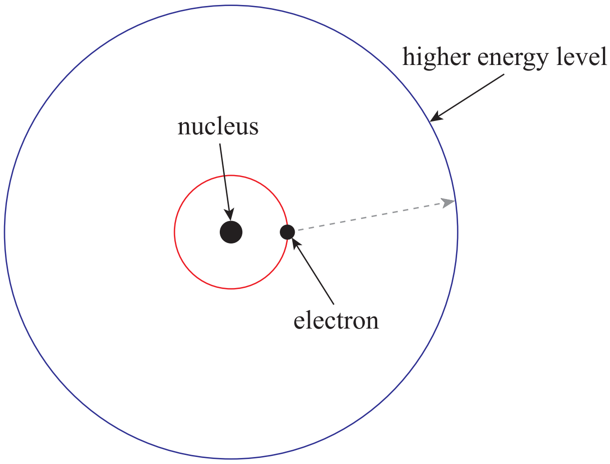
5. The diagram below shows a solid uncharged conducting sphere that has been placed in the region between two oppositely charged parallel plates:



[*This diagram is not drawn to scale.*]

On the diagram above, sketch the electric field in the region between the plates. (3 marks)

6. The electron in a hydrogen atom is orbiting in its ground state at a radius of 5.3×10^{-11} m. The atom is excited, causing the electron to move to a higher energy level, which is at a radius of 2.12×10^{-10} m.



[*This diagram is not drawn to scale.*]

Using proportionality, determine the factor by which the electric force on the electron due to the nucleus has changed.

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____ (3 marks)

7. A cyclotron operates with a potential difference of 3.2×10^{4} V across the dees. The cyclotron is used to accelerate hydrogen ions with a charge $q = +1.60\times10^{-19}$ C and a mass $m = 1.67\times10^{-27}$ kg.

(a) Explain how the electric field between the dees increases the speed of the hydrogen ions.

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___ (2 marks)

(b) (i) Show that the period T of the circular motion of the hydrogen ions is given by $T = \dfrac{2\pi m}{qB}$, where B is the magnitude of the magnetic field inside the cyclotron.

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___ (3 marks)

(ii) The magnitude of the magnetic field inside the cyclotron is $B = 1.3$ T.

Calculate the period of the circular motion of the hydrogen ions.

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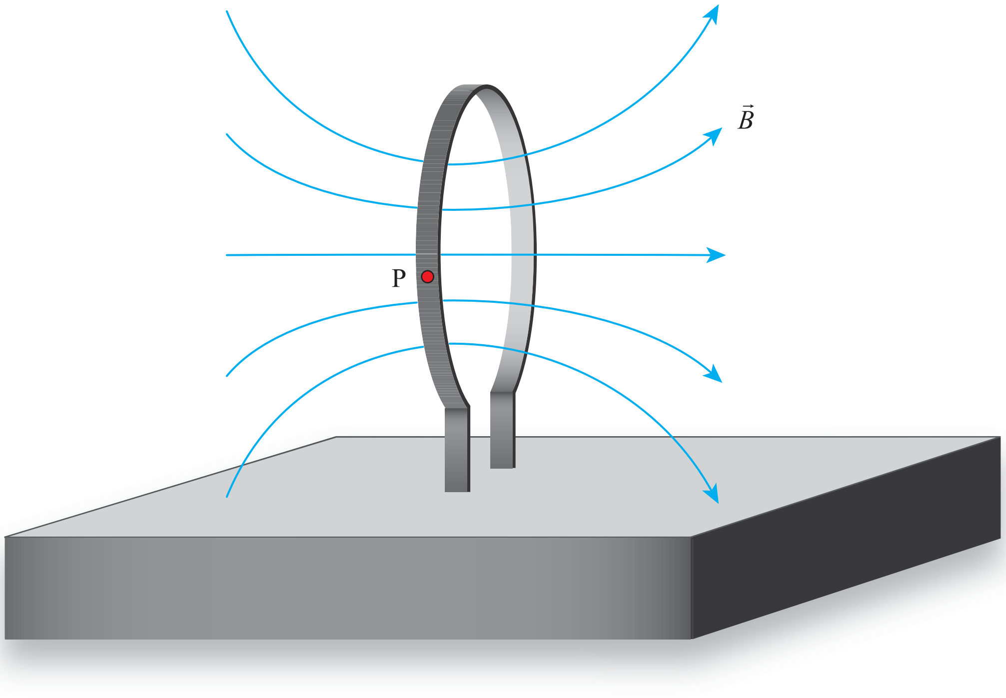
___ (2 marks)

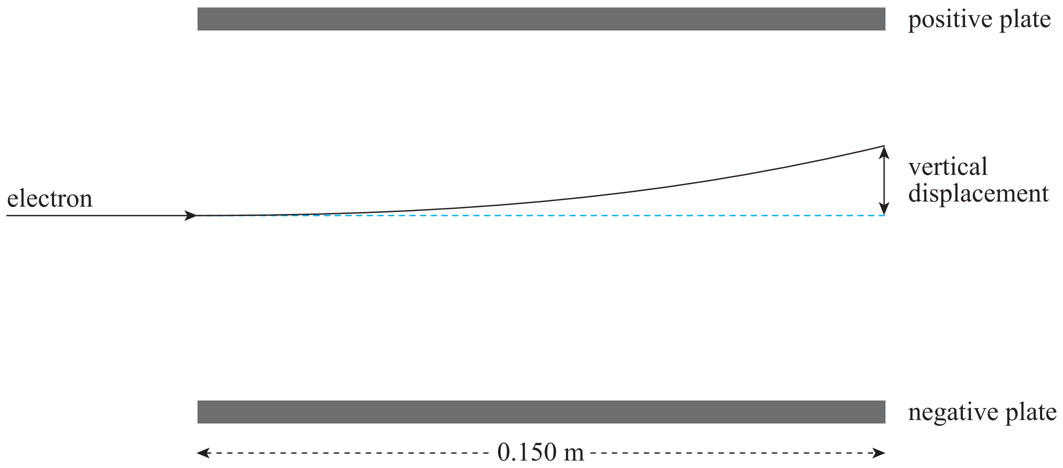
8. A loop of wire is arranged so that the plane of the loop is perpendicular to the surface of a desk, as shown in the diagram below. The magnetic field $\vec{B}$ is created by a current flowing in the loop.



[*This diagram is not drawn to scale.*]

Draw an arrow at point P on the loop of wire to show the direction of the conventional current in the loop. (1 mark)

9. An electron is fired horizontally into a uniform electric field in the vacuum between two oppositely charged parallel conducting plates, as shown in the diagram below. The electron enters the field halfway between the plates, with a speed of 2.10×10^{7} m s^{-1}. The plates are 0.150 m long, and the uniform electric field has a magnitude of 4.00×10^{3} V m^{-1}. *Ignore end effects and the effect of gravity.*



[*This diagram is not drawn to scale.*]

(a) Show that the time of flight of the electron through the uniform electric field is 7.14×10^{-9} s.

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____ (1 mark)

(b) (i) Show that the magnitude of the vertical acceleration of the electron in the region between the plates is $a = 7.03\times10^{14}$ m s^{-2}.

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____ (2 marks)

(ii) Calculate the vertical displacement of the electron as it leaves the electric field. Give your answer to the nearest millimetre.

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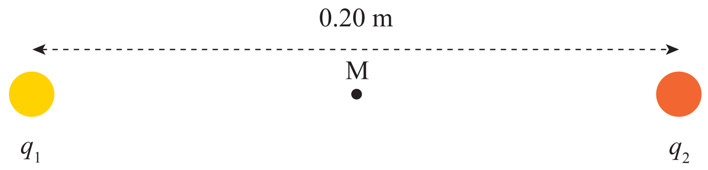
____ (3 marks)

10. Two point charges are placed in a vacuum, with a distance of 0.20 m between their centres. Charge $q_1 = -3.2\times10^{-6}$ C and charge $q_2 = -6.4\times10^{-6}$ C. Point M is halfway between the two charges.



[*This diagram is not drawn to scale.*]

(a) (i) State the direction of the electric field due to q_1 at point M.

____ (1 mark)

(ii) Show that the magnitude of the electric field due to q_1 at point M is 2.9×10^6 N C^{-1}.

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____ (2 marks)

(b) Determine the magnitude of the electric field due to q_2 at point M.

____ (1 mark)

(c) Hence calculate the magnitude and direction of the total electric field at point M.

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____ (3 marks)

11. A mass spectrometer is a device that can be used to separate the different isotopes of an element.

Carbon has three naturally occurring isotopes: carbon-12, carbon-13, and carbon-14.

(a) Explain why the isotopes of carbon are chemically identical.

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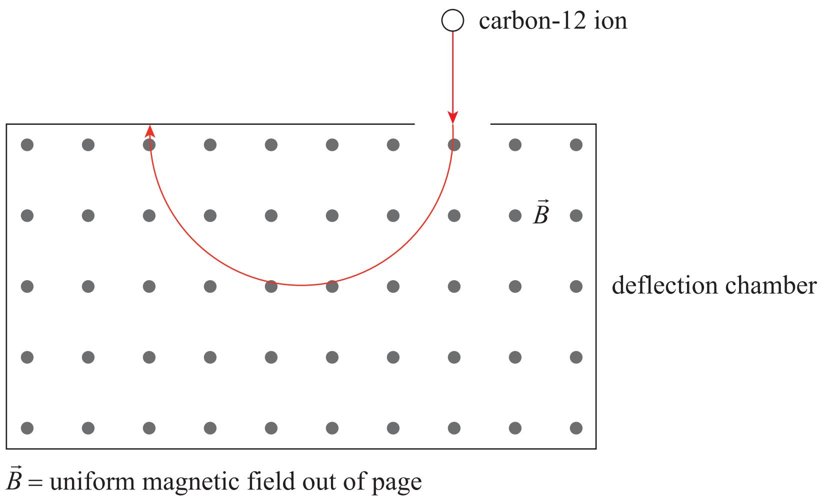
____ (2 marks)

(b) In a mass spectrometer, all ions enter a deflection chamber with the same velocity. The uniform magnetic field in the deflection chamber causes the ions to move in a semicircular path.

The diagram below shows the path taken by a carbon-12 ion in the deflection chamber:



[*This diagram is not drawn to scale.*]

(i) State the sign of the charge of the carbon-12 ion.

____ (1 mark)

(ii) Explain why the carbon-12 ion moves with uniform circular motion in the magnetic field in the deflection chamber.

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____ (3 marks)

(iii) On the diagram of the deflection chamber on the page opposite, draw the path that a carbon-14 ion with the same charge as the carbon-12 ion would be likely to take. Justify your answer.

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____ (3 marks)

12. (a) The length of the wire in the voice coil of a loudspeaker is 58 m. The wire carries a current of 0.125 A. The wire is within, and perpendicular to, a uniform magnetic field of magnitude 2.4×10^{-4} T.

Calculate the magnitude of the force acting on the wire.

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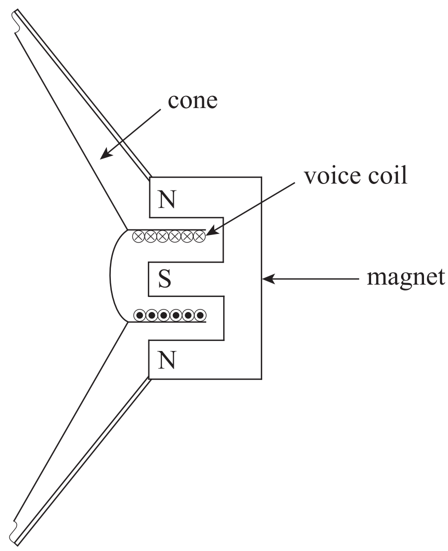
____ (2 marks)

(b) The diagram below shows the main components of a moving-coil loudspeaker:



[*This diagram is not drawn to scale.*]

Explain the action of the moving-coil loudspeaker.

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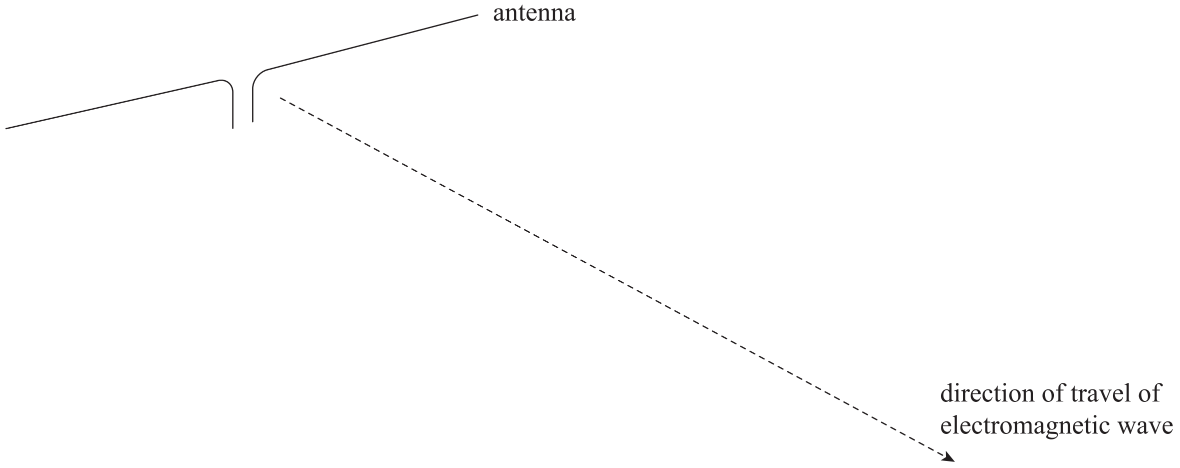
____ (4 marks)

13. The diagram below shows the direction of travel of one electromagnetic wave emitted by a horizontal transmitting antenna. The plane of polarisation of the wave is horizontal.



[*This diagram is not drawn to scale.*]

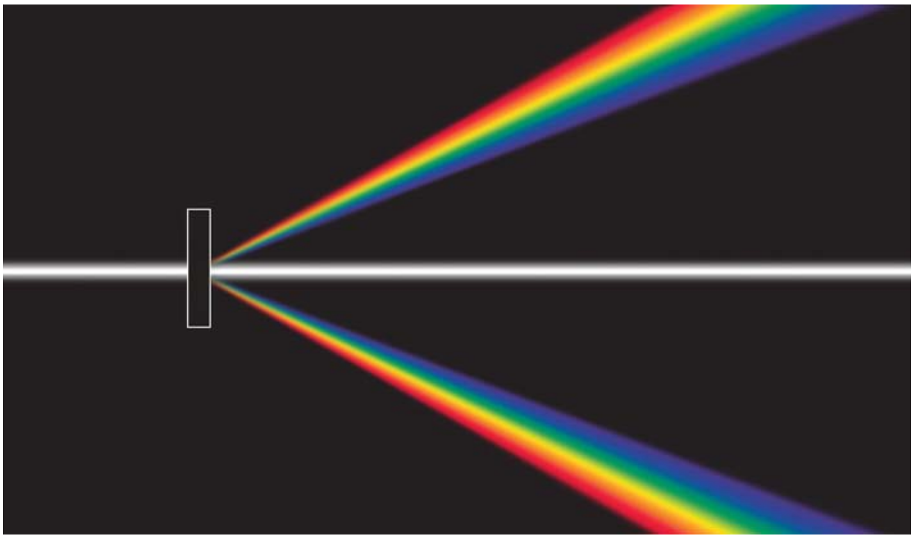
(a) State the orientation of the oscillating magnetic field of the electromagnetic wave.

____ (1 mark)

(b) State the orientation of the receiving antenna necessary for it to effectively receive the electromagnetic wave.

____ (1 mark)

14. The image below shows the diffraction of white light as it passes through a transmission diffraction grating:



Explain why the red light is diffracted through larger angles than the blue light in the first-order maxima.

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____ (2 marks)

You may write on this page if you need more space to finish your answers to Part 1 of Section A. Make sure to label each answer carefully (e.g. 7(b)(i) continued).

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SACE Board of SA

External Examination 2010

2010 PHYSICS

SACE REGISTRATION NUMBER

SEQ	FIGURES	CHECK LETTER	BIN

PHYSICS

QUESTION BOOKLET

2

21 pages, 11 questions

Tuesday 2 November: 9 a.m.

Part 2 of Section A and Part 1 of Section B

Write your answers to Part 2 of Section A and Part 1 of Section B in this question booklet.

SECTION A

Part 2 (Questions 15 to 24)

(56 marks)

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

15. A red laser beam illuminates two slits, producing an interference pattern that can be observed on a screen, as shown in the diagram below:

[*This diagram is not drawn to scale.*]

(a) Explain the bright fringes of the two-slit interference pattern.

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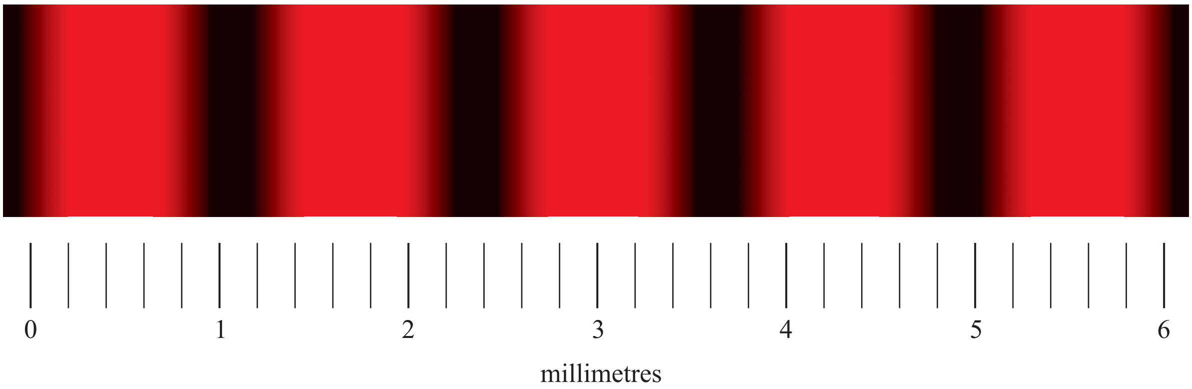
____ (3 marks)

(b) The slits are separated by a distance of 1.50×10^{-4} m. The screen is positioned 0.30 m from the slits.

The central part of the interference pattern observed on the screen is shown in the scale diagram below:



(i) Using the diagram above, determine the distance between adjacent maxima. Mark clearly on the diagram the measurements you have used.

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____ (2 marks)

(ii) Hence calculate the wavelength of the red laser beam.

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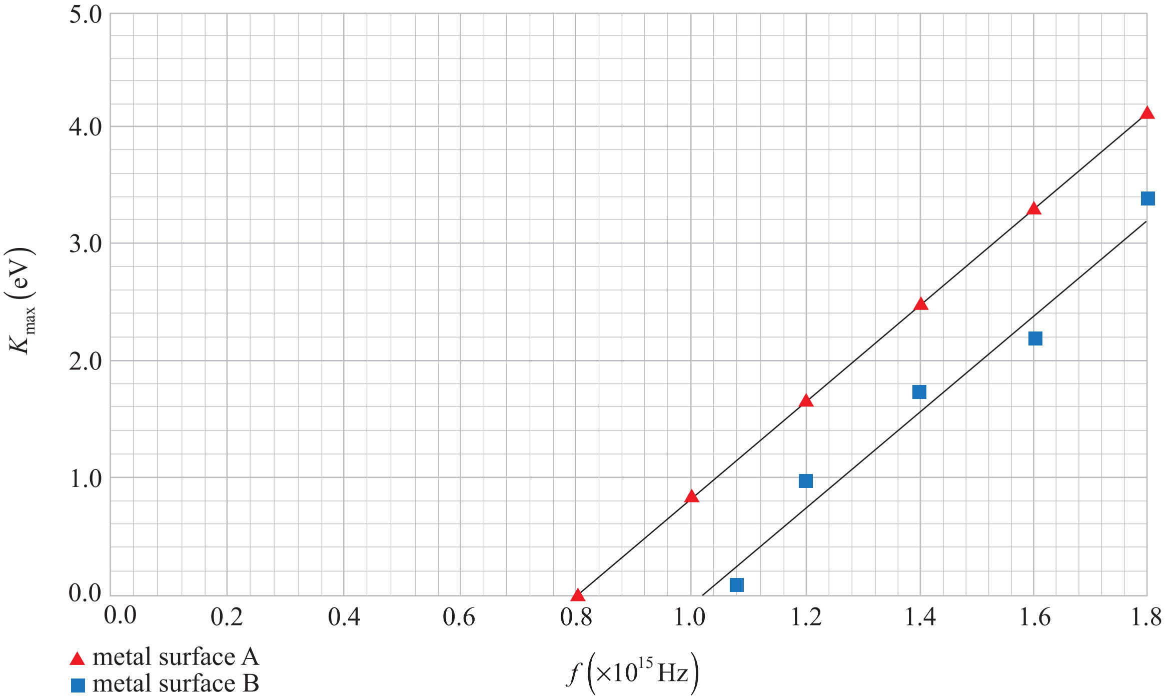
____ (3 marks)

16. An experiment was performed in which light of different frequencies f was incident on two different metal surfaces, A and B. Electrons were emitted from the metal surfaces, and their maximum kinetic energies K_{max} were measured. The graph below shows the results of the experiment:



(a) State which metal surface has the more precise set of measurements. Give a reason for your answer.

Metal surface:______

Reason:____

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____ (2 marks)

(b) Describe how Einstein used the concept of photons and the conservation of energy to explain the emission of electrons from a metal surface.

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____ (3 marks)

17. (a) Calculate the potential difference across an X-ray tube that produces X-rays with a maximum frequency of 6.0×10^{18} Hz.

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____ (3 marks)

(b) Explain the effect that an increase in the potential difference across the X-ray tube has on the penetrating power of the X-rays produced.

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____ (3 marks)

18. Mobile phones with Bluetooth® technology use microwaves with a frequency of 2.40 GHz.

Calculate the wavelength of these microwaves.

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__________________________________ (3 marks)

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Source: Adapted from www.cellphonedigest.net

19. An electron and a proton are travelling with the same speed.

State which one would have the shorter wavelength. Justify your answer.

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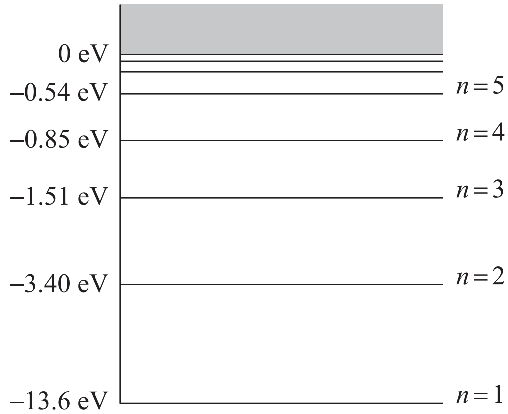
____ (3 marks)

20. Some of the energy levels of hydrogen at room temperature are shown in the diagram below:



[*This diagram is not drawn to scale.*]

A photon of 12.75 eV is incident on the hydrogen.

(a) Explain why this photon can be absorbed by the hydrogen.

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____ (2 marks)

(b) Calculate the frequency of the incident photon.

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____ (3 marks)

(c) The 12.75 eV photon can cause fluorescence in hydrogen.

(i) Explain what is meant by 'fluorescence'.

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____ (2 marks)

(ii) On the diagram opposite, draw one set of energy transitions that show the process of fluorescence. (1 mark)

(d) Explain why there are no absorption lines in the visible region for hydrogen at room temperature.

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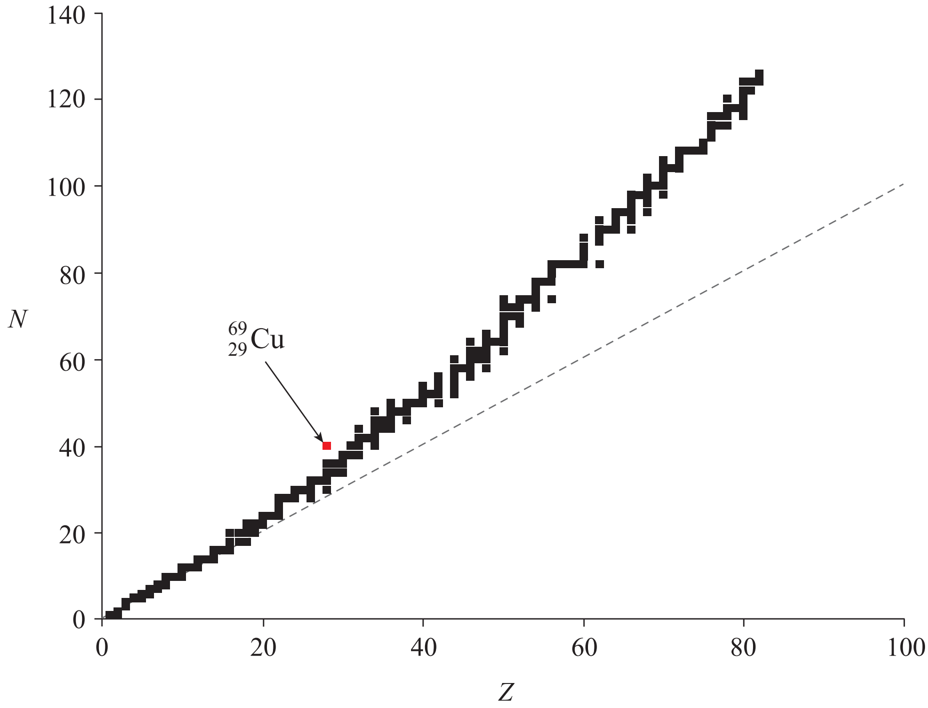
____ (2 marks)

21. The number of neutrons N and the atomic number Z for some stable nuclei are shown in the graph below. The position of the radioactive copper nucleus $^{69}_{29}Cu$ is indicated on the graph.



(a) Predict the likely type of decay for $^{69}_{29}Cu$.

____ (1 mark)

(b) Another radioactive copper nucleus is $^{57}_{29}Cu$, which decays to an isotope of nickel, $^{57}_{28}Ni$.

Name the two particles emitted in this decay.

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____ (2 marks)

22. The half-life of ${}^{18}_{9}F$ is 110 minutes. The activity of a sample of ${}^{18}_{9}F$ was measured at 12.30 p.m. and found to be 1.2×10^7 Bq.

Determine the activity that you would expect the sample to have at 6 p.m. the same day.

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____ (3 marks)

23. The following nuclear reaction can take place when a neutron collides with a boron nucleus:

$$ {}^{1}_{0}n + {}^{10}_{5}B \longrightarrow {}^{A}_{Z}X + {}^{4}_{2}He $$

(a) State the atomic number and the mass number of nucleus X.

Atomic number: _______________

Mass number: _________________ (2 marks)

(b) The masses of the particles involved in the collision are:

$$ {}^{1}_{0}n = 1.6749 \times 10^{-27} \text{ kg} $$

$$ {}^{10}_{5}B = 1.6627 \times 10^{-26} \text{ kg} $$

$$ {}^{A}_{Z}X = 1.1650 \times 10^{-26} \text{ kg} $$

$$ {}^{4}_{2}He = 6.6446 \times 10^{-27} \text{ kg.} $$

Calculate the difference in mass of the reactants and products, and hence determine the amount of energy that would be released as a result of this difference in mass.

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____ (4 marks)

(c) The neutron is moving to the east with a speed of $2.4\times10^{3}\ \mathrm{m\,s^{-1}}$. The boron nucleus $\left({}^{10}_{5}\mathrm{B}\right)$ is initially stationary.

(i) Show that the magnitude of the total initial momentum is $p_i = 4.0\times10^{-24}\ \mathrm{kg\,m\,s^{-1}}$.

(1 mark)

(ii) After the collision the helium nucleus $\left({}^{4}_{2}\mathrm{He}\right)$ moves to the east, with a momentum of $6.18\times10^{-20}\ \mathrm{kg\,m\,s^{-1}}$.

Determine the momentum of nucleus X.

(4 marks)

24. Nuclear fusion is not yet a viable source of power.

(a) State what is meant by the term ‘nuclear fusion’.

____

____ (1 mark)

(b) State one condition necessary for nuclear fusion to occur.

____

____ (1 mark)

(c) Discuss one advantage of nuclear fusion over nuclear fission as a future source of power.

____

____

____

____ (2 marks)

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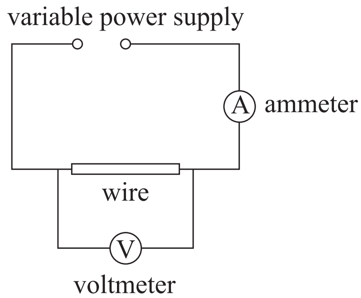
SECTION B

Part 1 (Question 25)

(20 marks)

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

25. An experiment using the equipment shown in the diagram is carried out to investigate the hypothesis that ‘the current in the wire I is directly proportional to the potential difference ΔV applied across the wire’, and to determine the resistance R of the wire, using $R = \frac{\Delta V}{I}$.



[*This diagram is not drawn to scale.*]

The potential difference across the wire is supplied by the variable power supply and measured (in volts V) by the voltmeter. The current in the wire is measured (in amperes A) by the ammeter.

The data recorded in the experiment are shown in the table below:

Potential Difference ΔV (V)	Current I (A)			
	Measurement 1	Measurement 2	Measurement 3	Average
0.0	0.010	0.009	0.009	0.009
1.0	0.049	0.046	0.047	
2.0	0.087	0.093	0.096	
3.0	0.139	0.142	0.137	
4.0	0.178	0.180	0.182	

(a) Complete the table above by calculating the average of the current measurements recorded when a potential difference is applied. (2 marks)

(b) State one factor that has been deliberately held constant throughout the experiment.

____ (1 mark)

(c) (i) State, giving a reason, which one of potential difference and average current should be on the horizontal axis of a graph of the data in the table above.

____

____

____

____ (2 marks)

(ii) On the page opposite, plot the data and draw a line of best fit. (6 marks)

(d) State whether or not your graph supports the hypothesis stated on page 16. Explain your answer.

____

____

____

______________________________________ (2 marks)

(e) Suggest the likely source of the systematic error in the experiment.

____

______________________________________ (1 mark)

(f) Determine the gradient of your line of best fit. Include the units of the gradient.

____

____

____

______________________________________ (3 marks)

(g) Use the gradient of your line of best fit to determine the resistance of the wire used in the experiment.

____

____

____

______________________________________ (2 marks)

Question 25 continues on page 20.

(h) The experiment is repeated with a different power supply, a different ammeter, and a different voltmeter.

The data recorded in the second experiment are shown in the table below:

Potential Difference ΔV (V)	Current I (A)		
	Measurement 1	Measurement 2	Measurement 3
0.0	0.00	0.00	0.00
1.0	0.04	0.03	0.04
2.0	0.08	0.07	0.08
3.0	0.13	0.13	0.13
4.0	0.17	0.17	0.18

State whether the ammeter used in the second experiment has a higher resolution or a lower resolution than the ammeter used in the first experiment.

____ (1 mark)

You may write on this page if you need more space to finish your answers to Part 2 of Section A or to Part 1 of Section B. Make sure to label each answer carefully (e.g. 16(b) continued).

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External Examination 2010

2010 PHYSICS

SACE REGISTRATION NUMBER			
SEQ	FIGURES	CHECK LETTER	BIN

PHYSICS

QUESTION BOOKLET

3

8 pages, 2 questions

Tuesday 2 November: 9 a.m.

Part 2 of Section B

Write your answers to Part 2 of Section B in this question booklet.

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SECTION B

Part 2 (Questions 26 and 27)

(30 marks)

*Questions 26 and 27 are extended-response questions. Answer **both** questions.*

Write your answers in this question booklet:

- Question 26, on pages 4 and 5, is worth 14 marks.
- Question 27, on pages 6 and 7, is worth 16 marks.

In answering these questions, you should:

- communicate your knowledge clearly and concisely;
- use physics terms correctly;
- present information in an organised and logical sequence;
- include only information that is related to the question.

You may use clearly labelled diagrams that are related to your answers.

26. Chain reactions are necessary to produce the sustained release of energy from the nuclear fission of ^{235}U. Moderators are necessary for chain reactions to occur.

- Explain what is meant by the term 'chain reaction'.
- Describe the role of moderators in chain reactions.
- Explain why the most effective moderators have atoms of low mass and low absorption of neutrons.

(14 marks)

27. A laser produces coherent light by stimulated emission. Coherent light is useful in determining the depth of water in the laser airborne depth sounder (LADS) system.

- Explain how the process of stimulated emission produces light that is coherent.
- Describe how the depth of a body of water can be determined by the detection of reflections of laser light from the surface and the bottom of the water.

(16 marks)

Source: www.navy.gov.au

You may write on this page if you need more space to finish your answers to Questions 26 and 27. Make sure to label each answer carefully (e.g. 26 continued).

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