Baulkham Hills High School

Yearly Examination

2015

Year 11

Physics

General Instructions:

- Reading time - 5 minutes
- Working time - 2 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board approved calculators may be used
- The following are provided
  - Data sheet
  - Formula sheet
  - Periodic table

Ensure you **enter your Name, Teacher, Class** on the top of **TWO** pages;

- P9 Section I - Multiple Choice Answer Sheet
- P11 Section II - Extended Response

Total Marks: 80

This paper consists of TWO sections.

Section I – Multiple Choice
20marks

- Attempt Questions 1-20
- Allow about 30 minutes for this section

Section II – Extended Response
60 marks

- Attempt Questions 21-31
- Allow about 90 minutes for this section
- All working must be shown

Booklets and papers, used or unused, are NOT to be taken from the examination room.

Section I – Multiple Choice
20marks
Select the alternative, A, B, C or D which best answers the question and indicate your choice on the Multiple Choice Answer Sheet.

1. Two types of electromagnetic waves are microwaves and gamma rays.

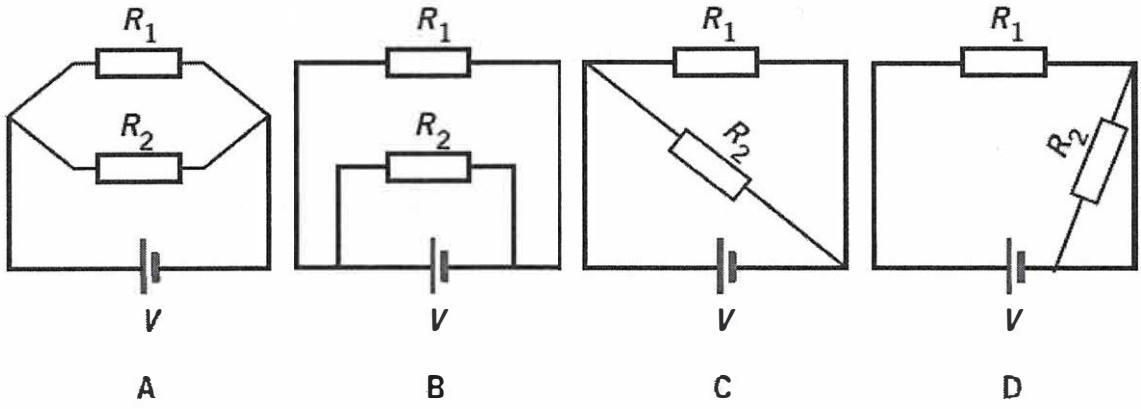
   Which alternative correctly describes a property that is shared by microwaves and gamma rays?

   (A) Both have high frequencies
   (B) Both have the same intensities
   (C) Both have long wavelengths
   (D) Both have the same speed in vacuum

2. What does the Principle of Superposition state happens when two waves of the same type pass through the same point in a medium?

   (A) Two waves of the same type cannot pass through the same point at the same time
   (B) The frequency of the resultant wave will be the same as the sum of frequencies of the component waves
   (C) The amplitude of the resultant wave will be the sum of the amplitudes of the component waves
   (D) The wavelength of the resultant wave will be the sum of the wavelengths of the component waves

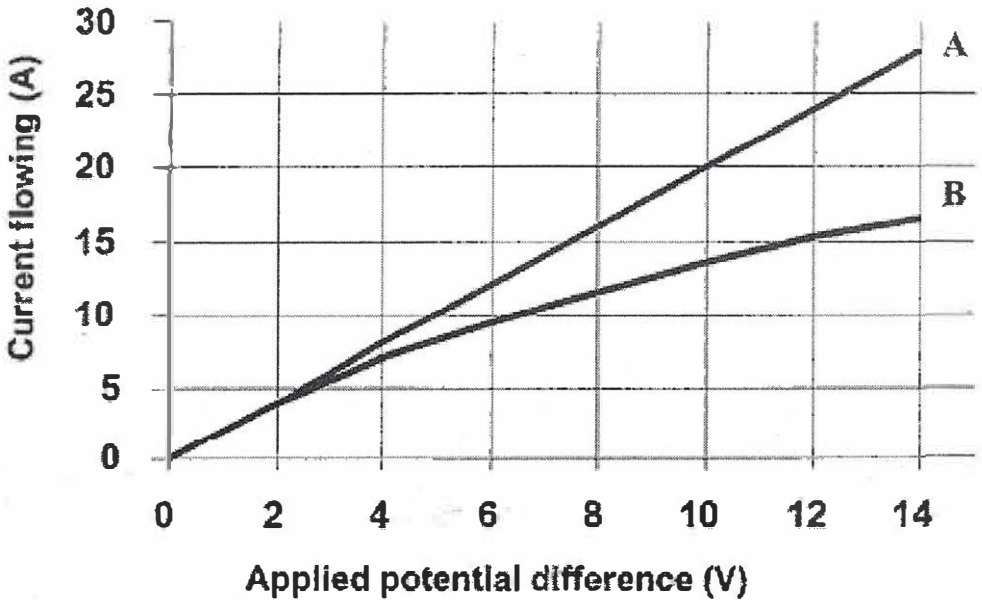
3. Three of the four electrical circuits in the figure below are equivalent parallel circuits drawn slightly differently. Which circuit is not electrically equivalent to the others?



4. If the intensity of a light source is doubled, which of the following occurs?

   (A) The intensity at each distance from the source will increase by a factor of 2
   (B) The intensity at each distance from the source will decrease by a factor of 2
   (C) The intensity at each distance from the source will increase by a factor of $\sqrt{2}$
   (D) The intensity at each distance from the source will increase by a factor of $\sqrt{2}$

5. Two resistors A and B are connected in a circuit and the current in each resistor is measured while the potential difference applied across their ends is varied.



Which statement about this information is correct?

(A) Resistor B is ohmic while resistor A is non-ohmic
(B) If 5 V is applied across the ends of resistor A, 10 A would flow through it
(C) Resistor A has a higher resistance than resistor B
(D) If the resistors were connected in series and 10 V was supplied to the circuit, 34 A would flow

6. A battery causes 15 A to flow through a 5 Ω conductor.

What power does the battery supply to the circuit containing the conductor?

(A) 75 V
(B) 75 W
(C) 375 V
(D) 1125 W

7. An electron in an electric field of strength 2.5 NC^{-1} experiences a force of F newtons.

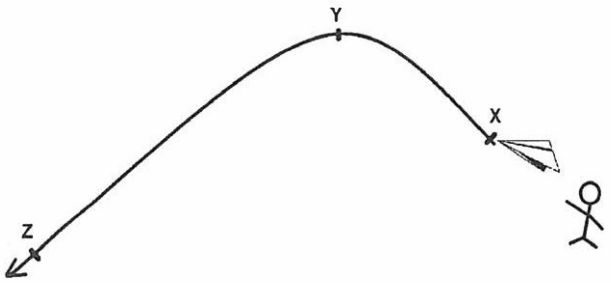
What would the force on a magnesium ion, Mg^{2+} in the same field be?

(A) 2 F newtons
(B) -2 F newtons
(C) 0.5 F newtons
(D) -0.5 F newtons

8. Which of the following information about a star CANNOT be obtained from an HR diagram?

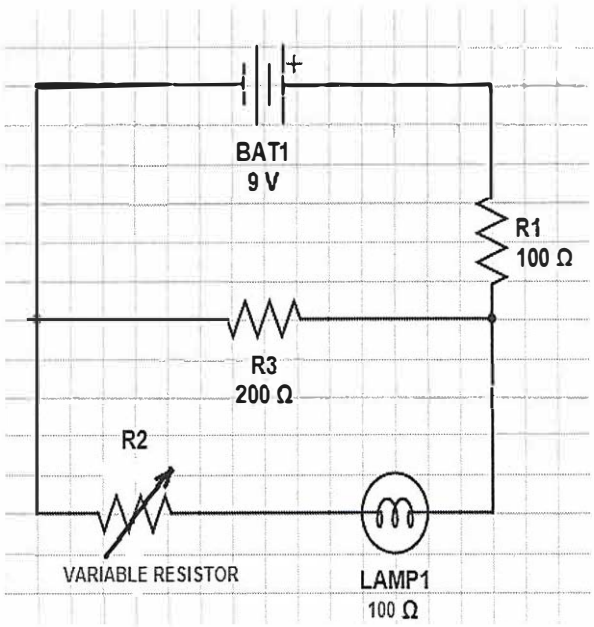
(A) Its luminosity
(B) Its surface temperature
(C) Its colour
(D) Its brightness

9. A student threw a paper plane up into the sky and it followed the flight path as shown below



(A) The kinetic energy decreased from X to Y then increased from Y to Z.
(B) The kinetic energy increased from X to Y then decreased from Y to Z.
(C) The kinetic energy increased from X to Y then increased again from Y to Z.
(D) The kinetic energy remained constant throughout the flight

The diagram of a circuit is used for Questions 10 and 11



10. If the total resistance of this circuit is 200 Ω, what is the value of the variable resistor?

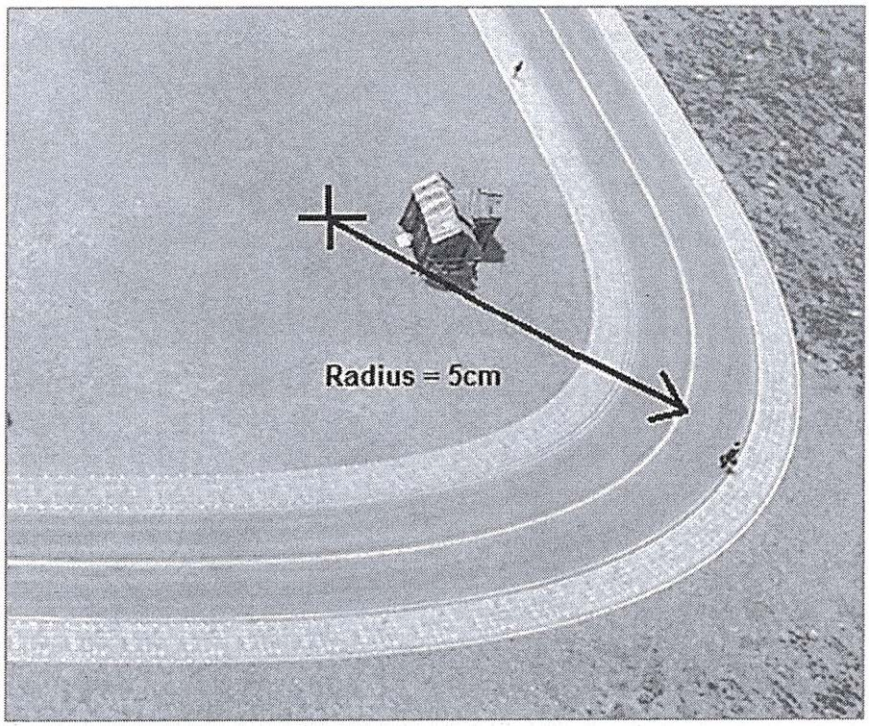
(A) 0 Ω
(B) 50 Ω
(C) 100 Ω
(D) 200 Ω

11. Which action will make LAMP1 glow brighter?

(A) Reduce the resistance of R2
(B) Reduce the resistance of R3
(C) Increase the resistance of R1
(D) Decrease the voltage from the battery

Answer both Question 12 and 13 with reference to the following information and diagram.

A student built a remote controlled toy car with a mass of 50 g. To test its performance, he drove it on a curved track as shown below.



12. What is the magnitude of the acceleration experienced by the remote controlled car as it moves around the bend at a constant speed of 0.5 ms^{-1}?

(A) 5.00 ms^{-2}
(B) 0.50 ms^{-2}
(C) 0.25 ms^{-2}
(D) 0.05 ms^{-2}

13. As the remote controlled car executes the turn with a uniform circular motion, which of the following statements is correct?

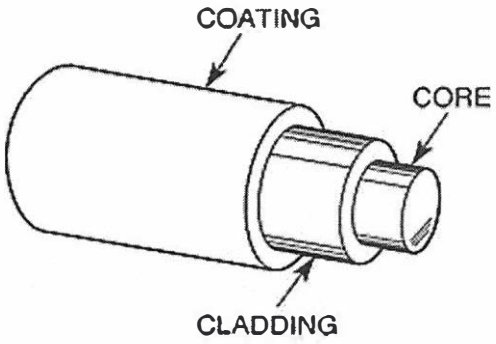
(A) Its impulse is zero
(B) Its kinetic energy remains constant
(C) It experiences a constant velocity
(D) The centripetal force must always be greater than its weight

14. A headlight consumes 12.0 Watt hours (Wh) within 30 minutes.

If it is directly connected to a 12 V lead-acid battery, how much current is passing through the headlight?

(A) 0.5 A
(B) 1.00 A
(C) 2.00 A
(D) 12.0 A

15. The diagram below illustrates the structure of an optical fibre designed for long distance communication.



Which of the following statements best describes the optical properties needed for the fibre to operate correctly?

(A) The core must have a greater refractive index than the cladding, whereas the coating needs to be opaque.
(B) The cladding must have a greater refractive index than the core, whereas the coating needs to be opaque.
(C) The core and the cladding must have an identical refractive index, whereas the coating needs to be opaque.
(D) The cladding must have a higher refractive index than both the core and the coating.

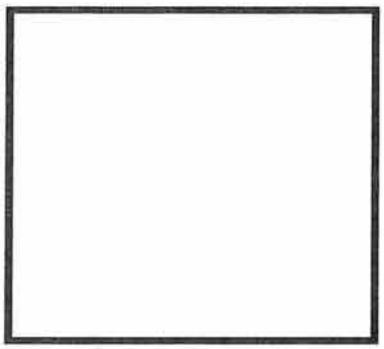
16. Which correctly describes the discovery made by Edwin Hubble?

(A) While observing the very edge of our visible universe from his telescope, he discovered that the universe began from a 'big bang'.
(B) He discovered that galaxies outside our own are moving away from us; the further they are away from us, the faster they move.
(C) He discovered that all the stars in our Milky Way are all moving away from us, which led him to believe that a big bang occurred at the centre of our Milky Way.
(D) He discovered the mathematical model that mass can be transformed into energy and the universe must have started with a 'big bang'.

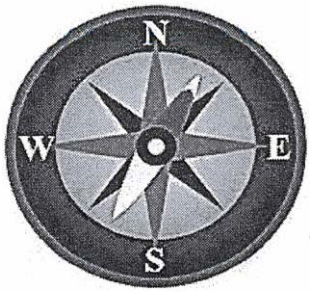
17. Which of the following statements about Luigi Galvani is most correct?

(A) He proposed that movement of muscle is generated by an electrical fluid carried by nerves.
(B) He proposed that electricity is generated when two different kinds of metal make contact with each other.
(C) He proposed that the voltage drop across a fixed resister should be proportional to current carried through it.
(D) He proposed that the sum of all current entering a point in the circuit must be equal to the total sum of current exiting the same point.

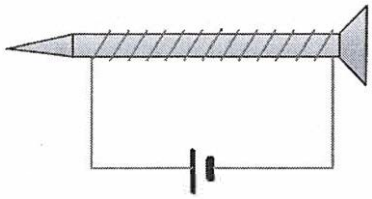
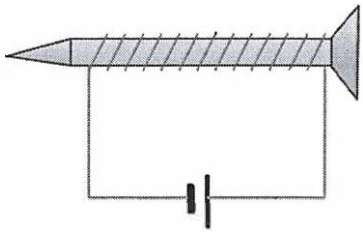
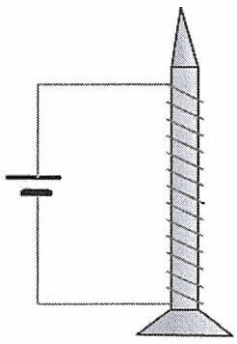
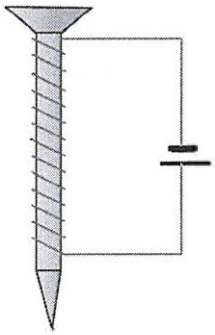
18. A student placed a compass on the right and an electromagnet (represented by the square) to its immediate left.



Electromagnet

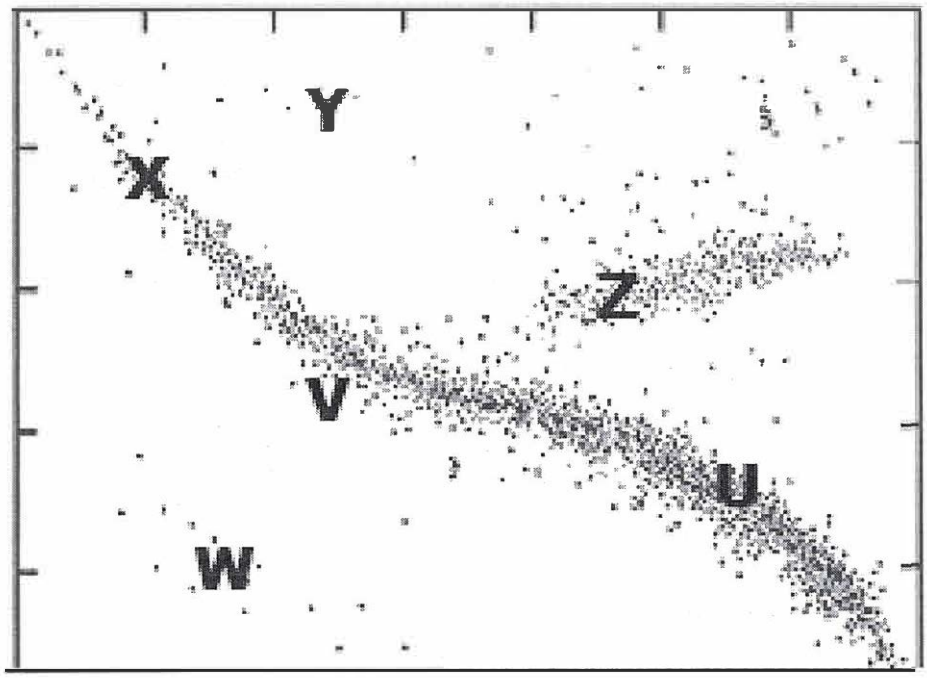


Assuming the magnetic field generated by the electromagnet is much stronger than the Earth's magnetic field in the region near the compass, which orientation of the electromagnet will cause the North-seeking needle of the compass to point towards the right?

(A)		(B)	
(C)		(D)	

Answer both Question 19 and 20 with reference to the following information and diagram.

Below is an H-R diagram with several specific stars labelled U–Z.



19. Which two stars would be fusing hydrogen as their main fuel source?

(A) V and W
(B) U and X
(C) Y and Z
(D) V and Z

20. Which star would have the shortest wavelength maxima (that is the wavelength corresponding to the maximum) of its associated black body curve?

(A) Star W
(B) Star U
(C) Star Z
(D) Star X

End of Section I

Name: ..... Teacher:.....Class:.....

Baulkham Hills High School
Yearly Examination 2015

Year 11
Physics

Section I – Multiple Choice Answer Sheet

Select the response A, B, C or D which best answers the question by placing an 'X' on the grid below.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

Ensure you enter Name/Teacher/Class on this page.

Name: ..... Teacher:.....Class:.....

Baulkham Hills High School

Yearly Examination

2015

Year 11 Physics

Section II – Extended Response

Questions 21-31
60 marks

Write your answers to Section II in the spaces provided

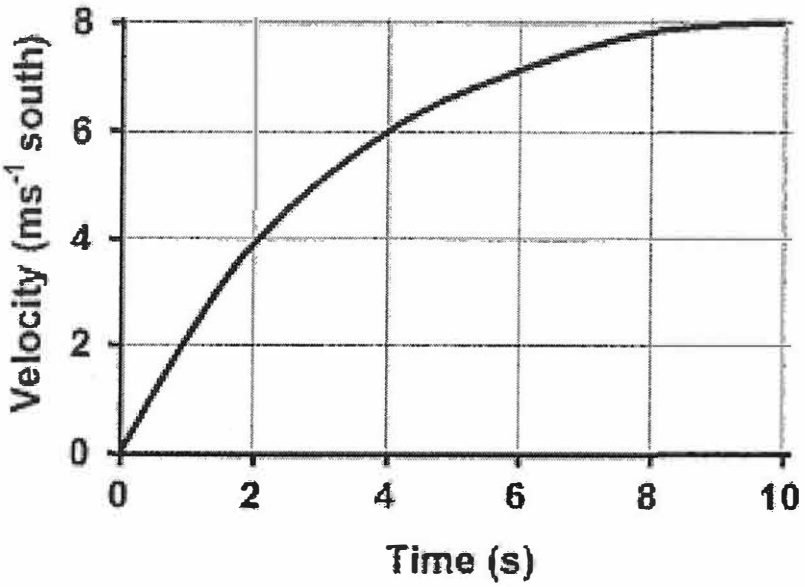
Show clearly all relevant working in your answers involving calculations

Ensure you enter Name/Teacher/Class on this page.

NB. There is no page 12

Question 21 (4 marks)

The graph below shows how the velocity of a car changes with time



(a) What is the approximate displacement of the car over the 10 seconds of travel shown? Show your working. **2**

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(b) What was the instantaneous acceleration of the car at time 2.0s? Show your working. **2**

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Question 22 (2 marks)

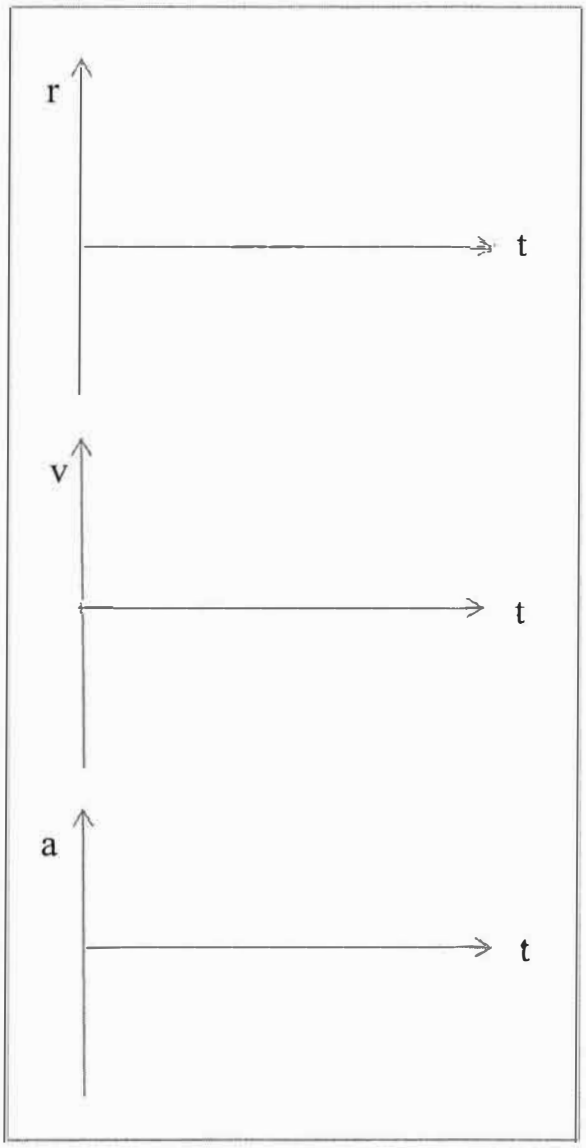
A student throws a ball straight up from the flat surface of the Earth. Assume 'up' is the positive direction and that the origin of each graph corresponds to zero for both axes.

(a) Sketch as a function of time the motion of a ball thrown up from the surface of the Earth until it returns to the Earth: **1**

(i) the altitude (r) of the ball,

(ii) the velocity (v) of the ball,

(iii) the acceleration (a) of the ball



(b) The student times the ball's return to Earth from its maximum height until it hits the ground to be 1.4 seconds. **1**

Calculate the maximum height reached by the ball. Show your working.

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Question 23 (7 marks)

In your course you studied magnetism, solenoids and electromagnets.

(a) Answer the following questions about the magnetic field:

(i) The direction of a magnetic field is defined by: **1**

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(ii) The strength of a magnetic field is defined by: **1**

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(iii) Identify one other feature of a magnetic field: **1**

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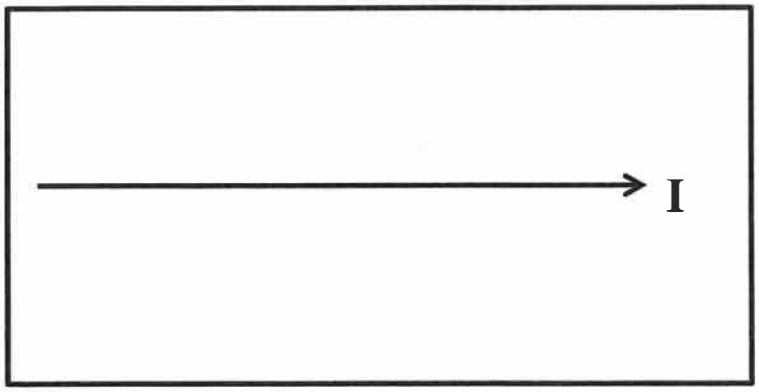
(b) In the box below, sketch the magnetic field around the current-carrying conductor **1**



(c) Compare an electromagnet with a solenoid: **1**

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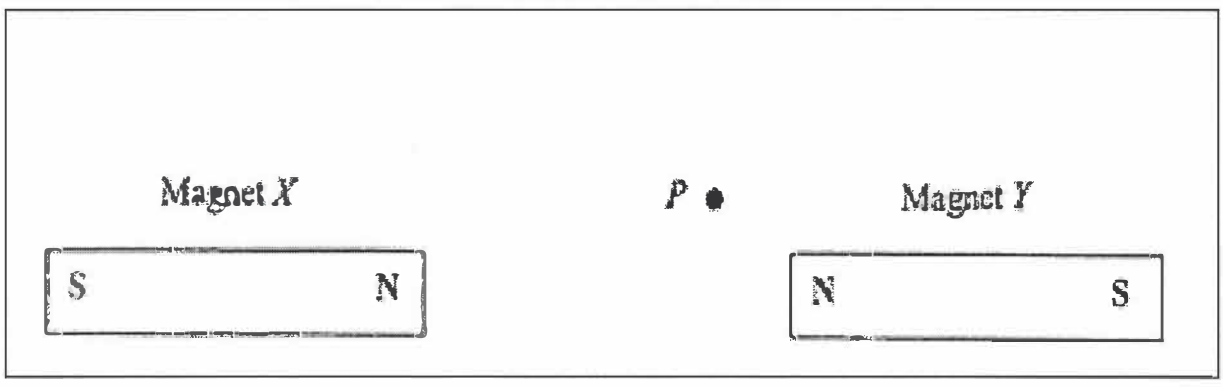
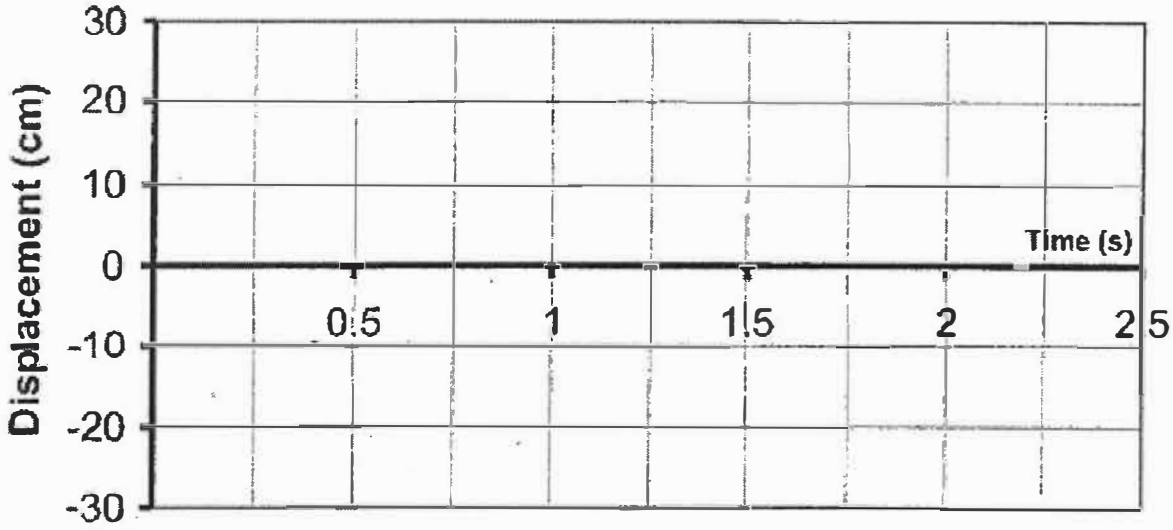
(d) The diagram in the box below shows the point P near two identical bar magnets, X and Y. By sketching a <u>vector diagram,</u> construct the direction of the NET (that is the total) magnetic field at P. **2**



Question 24 (6 marks)

(a) On the grid below, sketch a wave which has an amplitude of 25 cm and a frequency of 0.5 Hz **2**



(b) The diagram below represents a longitudinal wave. The particles of the medium carrying the wave are represented by the black dots and the rest positions of these particles by the vertical lines.

(i) Name a type of wave that this diagram could represent.

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On the diagram clearly show and label with the symbols given

(ii) Two particles a distance of one wavelength (λ) apart **1**

(iii) A rarefaction **(R)** **1**

(iv) A distance that represents the amplitude of the wave, **(A)** **1**

Question 25 (2 marks)

Consider the picture showing a man using an early hearing aid device

Explain how this device and the principle of reflection will work to improve the person's hearing **2**

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Question 26 (3 marks)

Compare the frequency and method of detection for radio waves and gamma radiation. **3**

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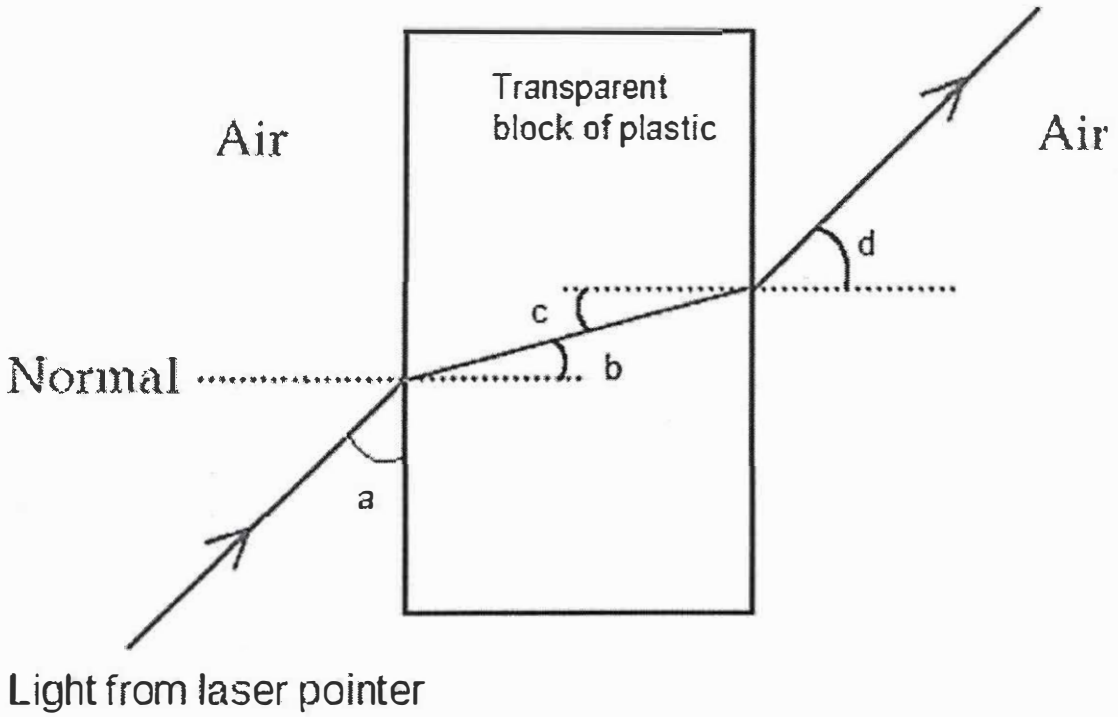
Question 27 (7 marks)

A student was given a task to measure the absolute refractive index of a block of transparent plastic.

She measured the angles according to the diagram below. She found angle (a) was 50.0°, angles (b) and (c) were 25.0° and angle (d) was 40.0°.



(a) Using the information above, determine the refractive index of this transparent plastic block. Assume the refractive index of air is 1.00. Show your working. **2**

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Question 27 continues on the next page

Question 27 (Continued)

(b) Determine the critical angle of total internal reflection at a plane interface between water (refractive index 1.33) and air (refractive index 1.00). Show your working. **2**

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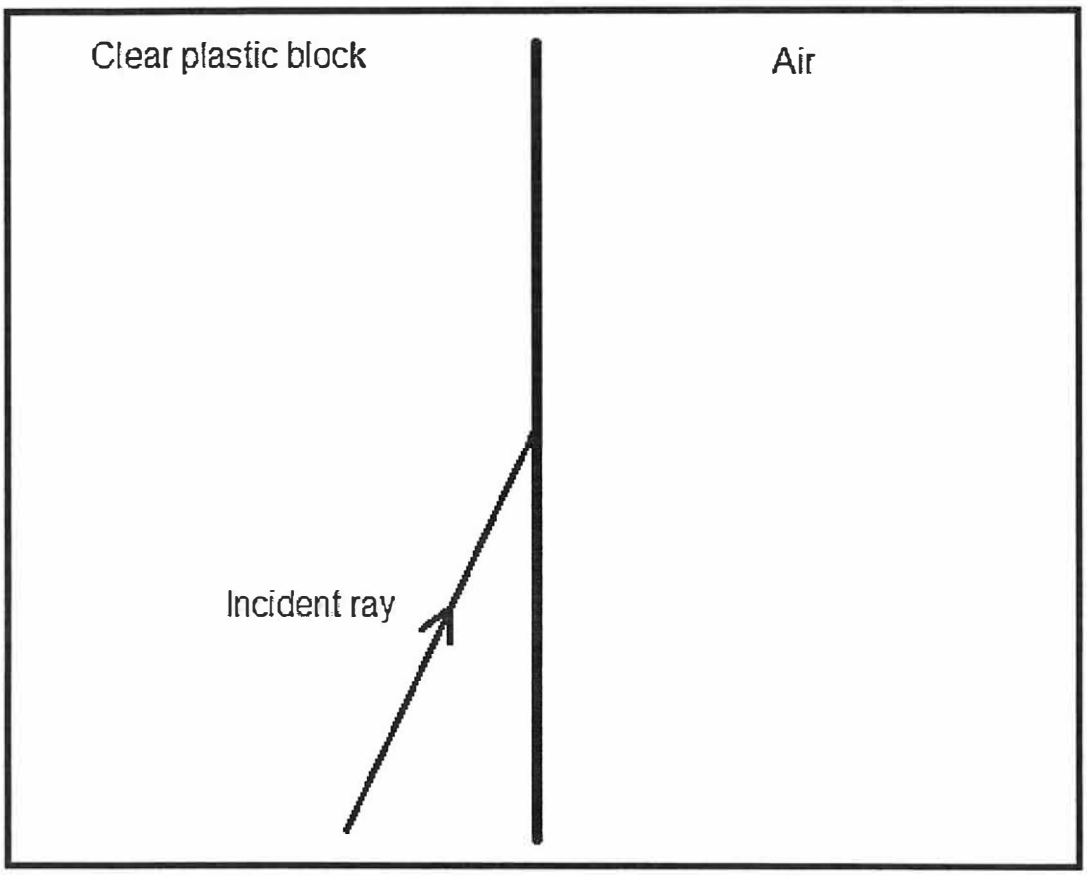
(c) In the diagram below the angle of incidence of the incident ray is approximately 5^{o} less than the critical angle. Complete the diagram to illustrate: **3**

(i) The refracted ray

(ii) The reflected ray



Question 28 (9 marks)

NASA's ongoing Lunar Laser Ranging Experiment measures the distance between the Earth and the Moon using laser ranging. Lasers on Earth are aimed at retroreflectors planted on the Moon during the Apollo program, and the time for the reflected light to return is measured.

http://en.wikipedia.org/wiki/Lunar_Laser_Ranging_experiment

(a) A green optical laser pulse on Earth is fired to the reflector on the Moon and it takes 2.50130s to detect the reflected pulse. Calculate the distance between Earth and the Moon. Show your working. **2**

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(b) Identify ONE reason why an ultra-violet laser would not be scientifically suitable for this experiment. **1**

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(c) Outline how FM radio uses radio waves to transmit audio signals to its listeners. **2**

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(d) Discuss the issues our society will encounter with our ever increasing use of wireless technology and the limited range of the electromagnetic spectrum available. **4**

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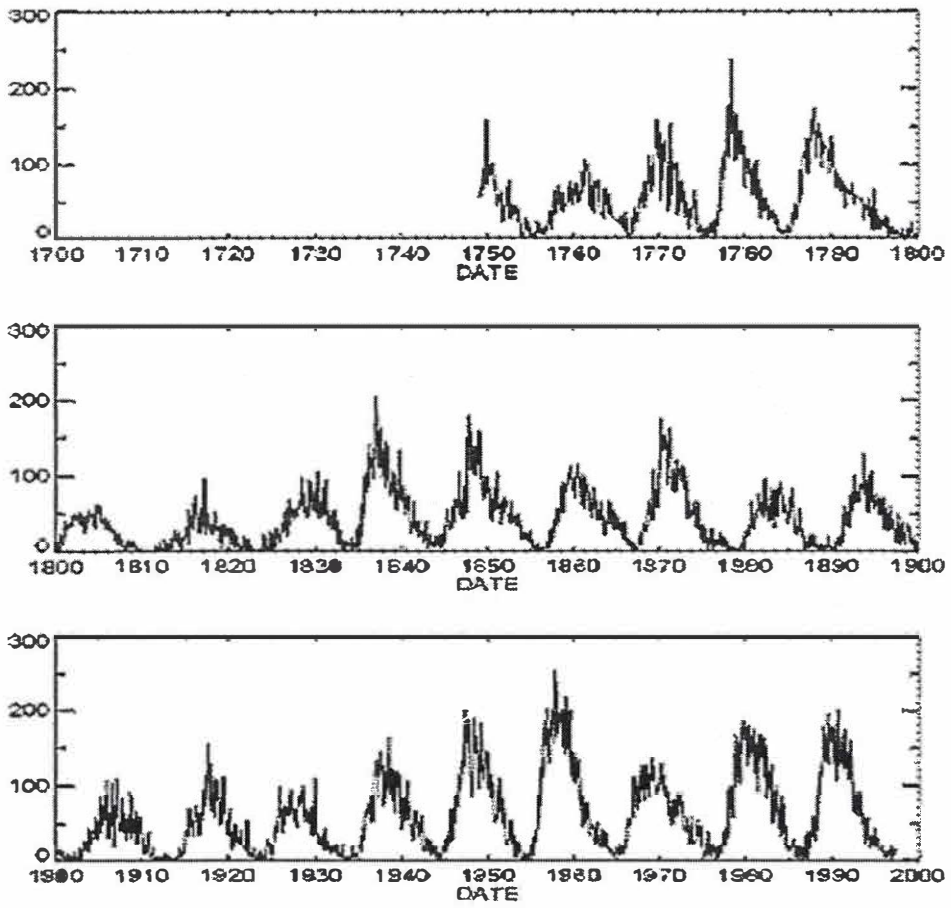
Question 29 (9 marks)

The diagram below shows the sunspot activity over time compiled by NASA between the 1700s to year 2000. The vertical axis represents the number of sunspots.



(a) Describe how you would determine the average period between solar maxima from the data above. **2**

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Identify TWO features of sunspots. **1**

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Question 29 continues on the next page

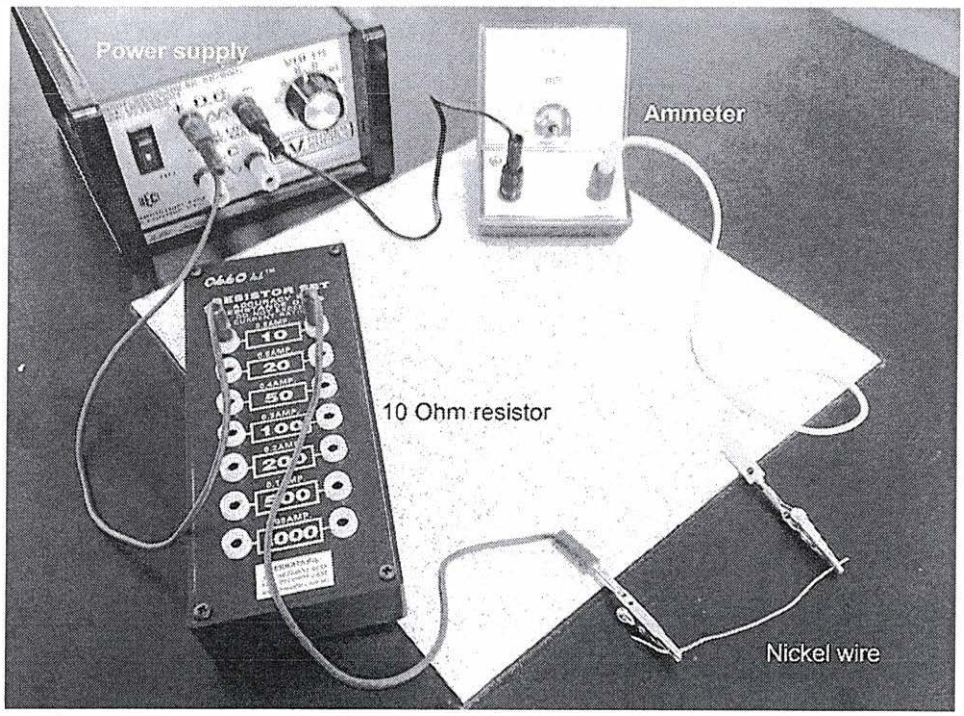
Question 29 (continued)

(c) Sunspot activity can fluctuate substantially. For example, on October 18, 2014, a sunspot rotated over the left side of the Sun, and soon grew to be the largest active region seen in the current solar cycle, which began in 2008. Currently, the sunspot has grown to 80 000 miles across -- more than ten times the diameter of Earth. **6**

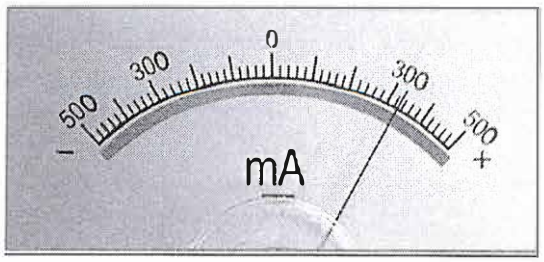
Assess the effects of elevated sunspot activity on human activities on Earth.

Question 30 (6 marks)

A student wants to determine the resistance of a piece of nickel wire. She set up the experiment as illustrated.



Below shows the ammeter's reading when the power supply is providing 4.00V in DC.



(a) Show that the resistance of the nickel wire is 2.12 Ω **2**

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Question 30 continues on the next page

Question 30 (continued)

(b) The back of the power supply has the warning label shown below.

Explain the necessity of the 10 Ω resistor in this experiment **2**

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(c) Calculate the energy consumption of the 10 Ω resistor in 5 minutes. Express your answer in kWh **2**

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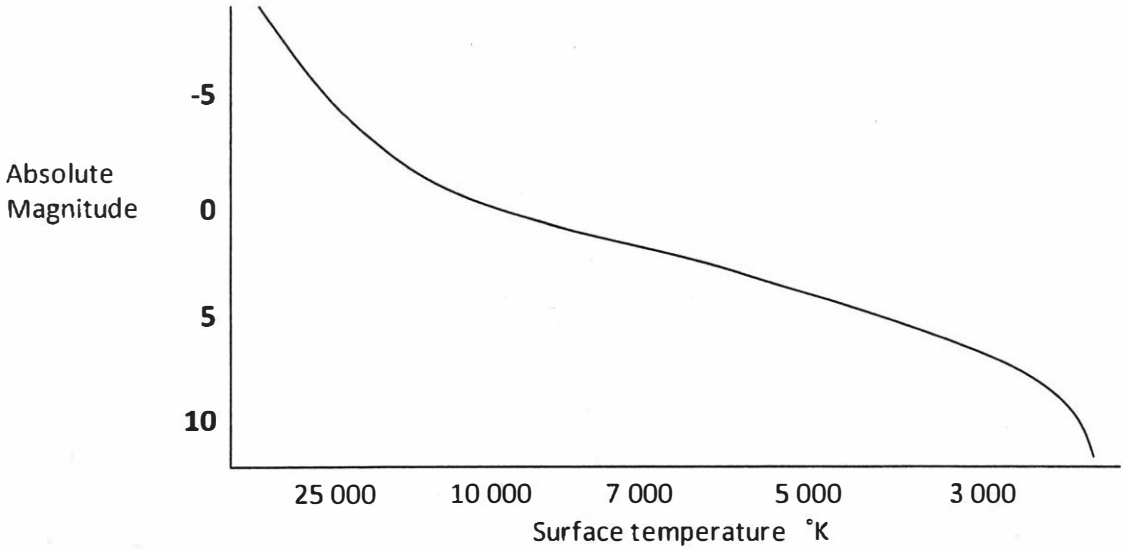
Question 31 (5 marks)

Below is a partial HR diagram



(a) Label the plotted line on the graph and add in and label the star groups that represent **3**

(i) the next stage in the life of a star the size of our Sun

(ii) the final stage in the life of a star the size of our Sun

(b) Identify an alternate label for the horizontal axis. **1**

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(c) Identify an alternate label for the vertical axis. **1**

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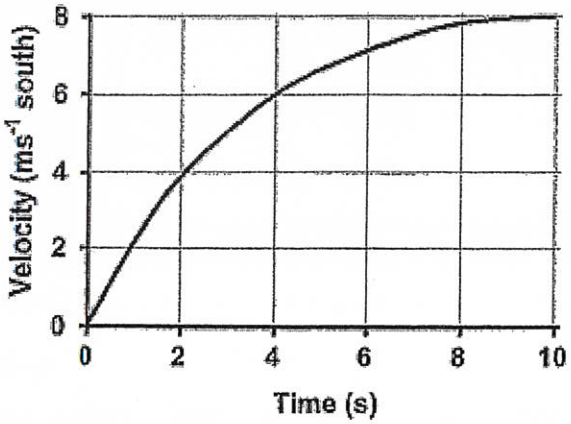
End of Section II
End of Paper

YR 11 PHYSICS 2015
YEARLY

1	D	6	D	11	A	16	B
2	C	7	B	12	A	17	A
3	D	8	D	13	B	18	B
4	A	9	A	14	C	19	B
5	B	10	C	15	A	20	D

Question 21 (4 marks)

The graph below shows how the velocity of a car changes with time



(a) What is the approximate displacement of the car over the 10 seconds of travel shown? Show your working. **2**

calculation of area under curve ...

~58m - (1) South - (1)

(b) What was the instantaneous acceleration of the car at time 2.0s? Show your working. **2**

gradient of the TANGENT to the line at t=2s ≈ ~1.3ms⁻² (1) (1)

Question 22 (2 marks)

A student throws a ball straight up from the flat surface of the Earth. Assume 'up' is the positive direction and that the origin of each graph corresponds to zero for both axes.

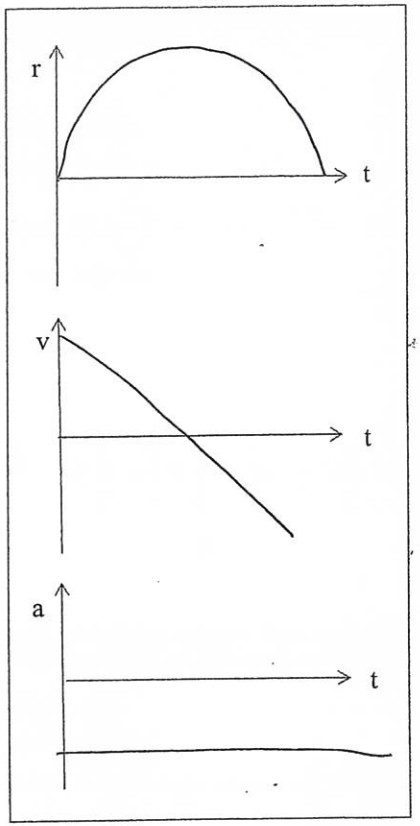
(a) Sketch as a function of time the motion of a ball thrown up from the surface of the Earth until it returns to the Earth: **1**

(i) the altitude (r) of the ball,

All 3 correct for 1 mk.

(ii) the velocity (v) of the ball,

(iii) the acceleration (a) of the ball



(b) The student times the ball's return to Earth from its maximum height until it hits the ground to be 1.4 seconds. **1**

Calculate the maximum height reached by the ball. Show your working.

$s = ut + \frac{1}{2}at^2$

$= 0 + \frac{1}{2}(9.8)1.4^2$

$\therefore s = 9.6m$ - (1)

Question 23 (7 marks)

In your course you studied magnetism, solenoids and electromagnets.

(a) Answer the following questions about the magnetic field:

(i) The direction of a magnetic field is defined by: 1

placing a compass (or equivalent explanation) - aligns

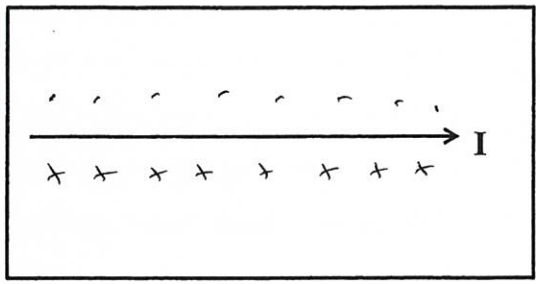
(ii) The strength of a magnetic field is defined by: 1

closeness / density of field lines

(iii) Identify one other feature of a magnetic field: 1

any legit. answer (according to Mr B)

(b) In the box below, sketch the magnetic field around the current-carrying conductor 1

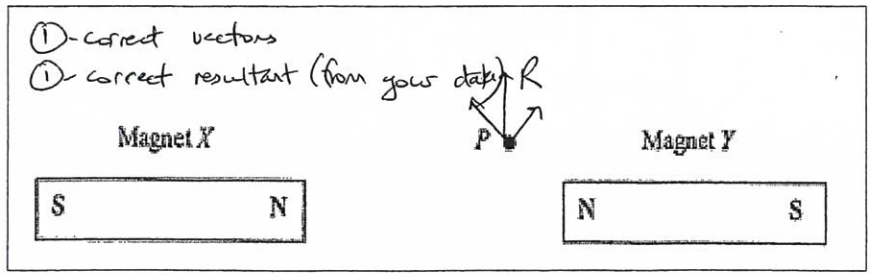


→ can be shown in another way, but must not be ambiguous.

(c) Compare an electromagnet with a solenoid: 1

electromagnet has a soft iron core; solenoid doesn't.

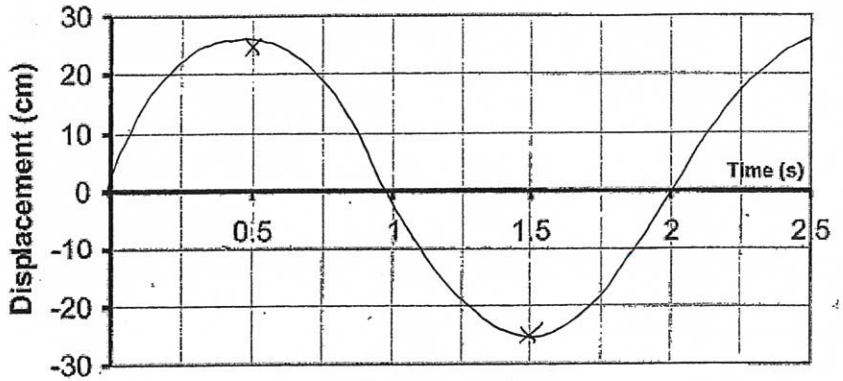
(d) The diagram in the box below shows the point P near two identical bar magnets, X and Y. By sketching a vector diagram, construct the direction of the NET (that is the total) magnetic field at P. 2



① - correct vectors
① - correct resultant (from your data) R

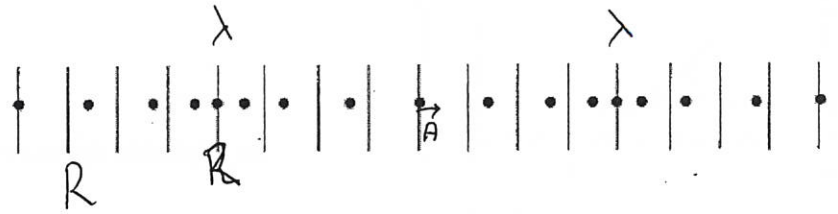
Question 24 (6 marks)

(a) On the grid below, sketch a wave which has an amplitude of 25 cm and a frequency of 0.5 Hz 2



correct frequency - ①
correct amplitude - ①

(b) The diagram below represents a longitudinal wave. The particles of the medium carrying the wave are represented by the black dots and the rest positions of these particles by the vertical lines.



(i) Name a type of wave that this diagram could represent. 1

Sound (not "longitudinal")

On the diagram clearly show and label with the symbols given

(ii) Two particles a distance of one wavelength (λ) apart 1

(iii) A rarefaction (**R**) 1

(iv) A distance that represents the amplitude of the wave, (**A**) 1

Question 25 (2 marks)

Consider the picture showing a man using an early hearing aid device

NOTE CONTINUES

$v = \lambda f$

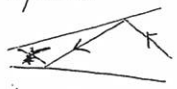
$\lambda = (300\ m/s)/f$

2kHz $\lambda = 1.5 \times 10^{-1}\ m$

20kHz $\lambda = 1.5 \times 10^{-2}\ m$

∴ Phase is not a problem.

NOTE This type of reflection



is NOT an echo.

Explain how this device and the principle of reflection will work to improve the person's hearing 2

- Identifies collector dish large area to small area at ear [1 mark]
- Identifies reflection along tube [1 mark]

eg: The large collector at the start of the device ~~acts like a~~ collects energy over a large area. These sound waves are then refleted continually along the walls of the tube which funnels the energy into the smaller area at the ear ...piece... The amount of energy relates to loudness which makes hearing easier.

NOTE The wavelength of sound waves is not much greater than the diameter of the tube so "interference effects" are not going to happen. *

Question 26 (3 marks)

Compare the frequency and method of detection for radio waves and gamma radiation. 3

Q26

- Identifies higher frequency wave (γ) [1 mark]
- Identifies detector for γ - photographic / Geiger counter [1 mark]
- Identifies detector for radio - antenna (long wire) [1 mark]

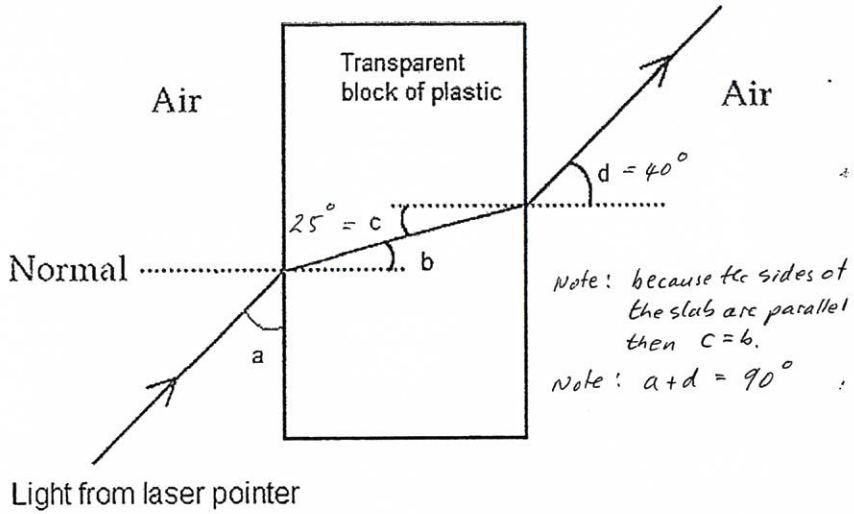
eg: γ radiation has a much higher frequency than radio waves. γ radiation may be deteted using a Geiger counter (or photographic film) while radio waves are detected by metal antennae which convert radio waves to electrical signals.

Note: Satellites are NOT detectors of radio signals - they employ a radio detector - a dish to concentrate and a length of conductor to detect.

Question 27 (7 marks)

A student was given a task to measure the absolute refractive index of a block of transparent plastic.

She measured the angles according to the diagram below. She found angle (a) was 50.0°, angles (b) and (c) were 25.0° and angle (d) was 40.0°.



Note: because the sides of the slab are parallel then c = b.

Note: a + d = 90°

(a) Using the information above, determine the refractive index of this transparent plastic block. Assume the refractive index of air is 1.00. Show your working. 2

$n_c \sin\theta_c = n_a \sin\theta_d$ n_d = refractive index air = 1.00

$n_c \sin(25) = \sin(40)$

$n_c = \sin(40)/\sin(25) = 0.6428/0.4226 = 1.5210$

$\therefore n_c = 1.52$

Note you are give R.I. air = 1.00 which is 3 significant figures.

Question 27 continues on the next page

Question 27 (Continued)

(b) Determine the critical angle of total internal reflection at a plane interface between water (refractive index 1.33) and air (refractive index 1.00). Show your working. **2**

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

at the critical angle of TIR $\theta_2 = 90°$, $\sin\theta_2 = 1$

$\therefore n_1 \sin\theta_{1c} = n_2$

$\theta_{1c} = \sin^{-1}\left(\frac{n_2}{n_1}\right) = \sin^{-1}\left(\frac{1.00}{1.33}\right) = 48.8°$

1 error lose 1 mark | 2 errors lose 2 marks.

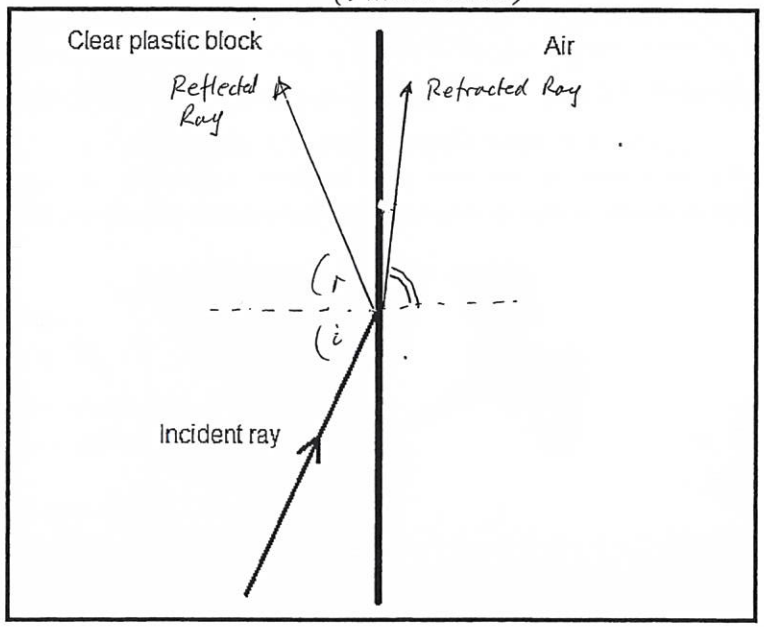
(c) In the diagram below the angle of incidence of the incident ray is approximately 5° less than the critical angle. Complete the diagram to illustrate: **3**

(i) The refracted ray

(ii) The reflected ray

- correctly illustrates reflected ray in correct direction
- correctly " refracted " " " "
- Indicates correct relative size of angle.

(1 MARK EACH)



Question 28 (9 marks)

NOTE: You are expected to use the correct and appropriate METALANGUAGE in your answers.

NASA's ongoing Lunar Laser Ranging Experiment measures the distance between the Earth and the Moon using laser ranging. Lasers on Earth are aimed at retroreflectors planted on the Moon during the Apollo program, and the time for the reflected light to return is measured.
http://en.wikipedia.org/wiki/Lunar_Laser_Ranging_experiment

(a) A green optical laser pulse on Earth is fired to the reflector on the Moon and it takes 2.50130s to detect the reflected pulse. Calculate the distance between Earth and the Moon. Show your working. **2**

$d = V \times t/2 = 3.00 \times 10^8 \times 2.50130/2 = 3.75195000 \times 10^8$

↑ From BOS Data sheet! $= 3.75 \times 10^8$ m

Note: this is a 3sf × 6sf so ans should be to 3sf.

(b) Identify ONE reason why an ultra-violet laser would not be scientifically suitable for this experiment. **1**

Recognise + Name — metalanguage expected - eg absorbed - not blocked (not filtered as can have bandpass or bandstop)

Because the atmosphere would absorb a significant amount of UV radiation.

↓ [note: not much reflected]

(c) Outline how FM radio uses radio waves to transmit audio signals to its listeners. **2**

Outline: sketch in general terms; indicate the main features of

USE THE WORDS IN THE QUESTION

(A) Identifies that the radio wave acts as the carrier wave

(B) Identifies that the carrier's frequency is modulated by the audio signal; the carrier frequency is shifted in response to the amplitude of the audio signal.

(Note: that the carrier's (ie. Radio Wave) amplitude is kept constant when modulating)

FM is NOT a sky-wave - it does not bounce of ionosphere

(d) Discuss the issues our society will encounter with our ever increasing use of wireless technology and the limited range of the electromagnetic spectrum available. **4**

See Next page.

Question 28 (9 marks)

(d) Discuss the issues our society will encounter with our ever increasing use of wireless technology and the limited range of the electromagnetic spectrum available. (4 Marks)

One Mark for each of A-D

A – Describes the limited nature of available EM for wireless
eg. limited from shorter radio waves to visible as UV, X-Ray, gamma ray are dangerous to biological systems. Long radio waves require long ariels and become impractical for hand held devices. The available spectrum must be divided into channels of finite bandwidth; higher data rates require larger bandwidth. Neighbouring broadcast on the same carrier frequency can overlap and cause interference

B – Describes wide range of uses society has for wireless communications (new technologies) and ever increasing demands (higher data rates, increasing population, decreasing poverty)

C – Relates A & B to positive/negative impact on society (supply and demand means costs to the user will increase, stricter regulations, the spectrum is a finite resource and political/business conflict)

D – Relates A & B to another positive/negative impact on society

Example Answer:

Rate of which information is transferred wirelessly depends on the range of frequency available for the transmitted signal. As our society grows in population and technology, the amount of people connected wirelessly and the size of the data will also increases. However, there is a finite amount of EMR spectrum available. This means people who live physically close to each other will start to interfere with each other's wireless communication, resulting in loss of quality and even connection.

Wireless communication would also be rendered unusable during mass gatherings where there are too many interfering signals at the same time, such as congestion during New Year Eve celebrations.

There even could be disputes between nations on rights to use section of the spectrum if they are too close to each other. This problem is serious and our society will run out of spectrum for wireless communication in the future if we do not come up with better means to manage these problems.

Notes:

- Discuss – identify issues and provide points for and/or against
- You cannot gain a mark just by rewriting/rewording parts of the question without adding a significant point of your own. (It is a good idea, however, to use the metalanguage included in the question)
- You are expected to use correct and appropriate metalanguage, not just vague words/statements
- Keep to the question; it is not asking for solutions
- OT = Off Topic
- Contradictions and errors lose a mark

Question 29 (continued)

(c) Sunspot activity can fluctuate substantially. For example, on October 18, 2014, a sunspot rotated over the left side of the Sun, and soon grew to be the largest active region seen in the current solar cycle, which began in 2008. Currently, the sunspot has grown to 80 000 miles across -- more than ten times the diameter of Earth. 6

Assess the effects of elevated sunspot activity on human activities on Earth.

(a) 2 marks

Criteria	Marks
• Describes taking all peak to peak duration and then take average over 250 yrs.	2
• Describes taking one measurement between peak to peak from the graph OR	1
• Adding individual p-to-p periods and dividing by total number of peaks	

(b) 1 mark

• Identify any TWO valid features of sunspots	1

Answer may include:
Sunspots are region of the Sun's photosphere where it has lower surface temperature and intense magnetic field.

(c) 6 marks

• Identifies at least two impacts. • Describes in detail how at least two would affect society • Makes a value statement with respect to the impacts identified	6
• Identifies at least two impacts. • Describes how at least two would affect our society	4-5
• Identifies at least two impacts OR • Identifies one impact and describes how it would affect our society	2-3
• Identifies one impact	1

Answer may include:
Sunspots activity can lead to solar flares or a Coronial Mass Ejection. If Earth is in the path of such high energy ionising particles, it can penetrate our atmosphere and could cause damage to power grids and to satellite communication systems

In Canada, the entire province of Quebec suffered from a blackout due to such event. The ensuing problems can range from failing of sewage treatment, losing refrigeration at the supermarket, loss of traffic control to endangering patients under surgery or living on live support.

Damage to satellite communication can be disruptive to global communication on satellite phones. Malfunction of GPS would lead to navigation problem on air, sea and the sky.

Overall, elevated sunspot activity can be potentially devastating to human activities on Earth.

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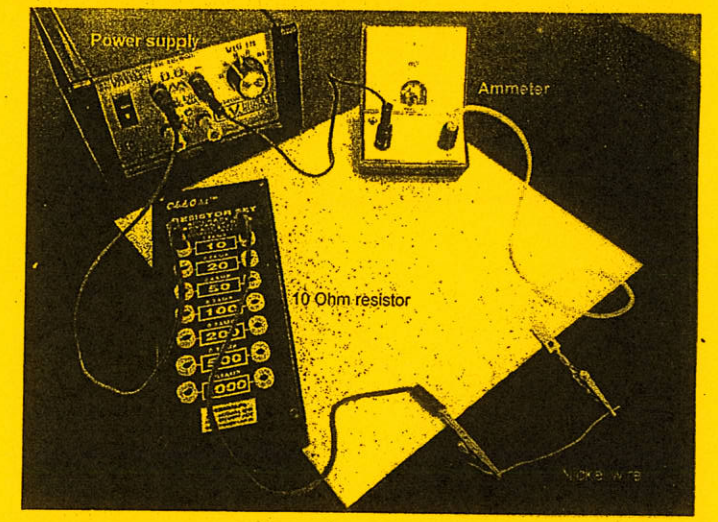
Question 30 (6 marks)

A student wants to determine the resistance of a piece of nickel wire. She set up the experiment as illustrated.



Below shows the ammeter's reading when the power supply is providing 4.00V in DC.

(a) Show that the resistance of the nickel wire is 2.12 Ω 2

$V_T = 4V$
$I_T = 330\,mA = 0.33\,A$
$R_T = ?$

$V = IR$
$R = V/I = 4/0.33$
$= 12.12\,\Omega$

$R_T = 12.12 = 10 + R_{Nickel}$

$\therefore R_{Nickel} = 2.12\,\Omega$ (2 marks) with working

1 error = 1 mark

Question 30 continues on the next page

Question 30 (continued)

(b) The back of the power supply has the warning label shown below.

Students who assumed that the fuse is in the 240 Volt circuit could perform calculations to determine the resulting maximum current in a 4 Volt circuit and 'justify' the effect of a 10Ω Resistor.

240-250V
50Hz
Fuse rated at 250mA
Made in Australia

Students who assume that the fuse is in the 4 Volt circuit could show mathematically that it is not suitable in this circuit with or without the 10Ω resistor as

Explain the necessity of the 10 Ω resistor in this experiment 2

the current exceeds this value already! (330 mA)

Students needed valid mathematically arguments to be awarded 2 marks.

One mark was given for clearly explaining how the inclusion of a 10Ω resistor results in a lower current which might/might not be below the fuse rating.

(c) Calculate the energy consumption of the 10 Ω resistor in 5 minutes. Express your answer in kWh 2

1 mark

$E = VIt = \left(\frac{10}{12.12} \times 4\right) \times 0.33 \times (5 \times 60)$

$= 326.7\,J$ OR $326.7\,Ws$

1 mark

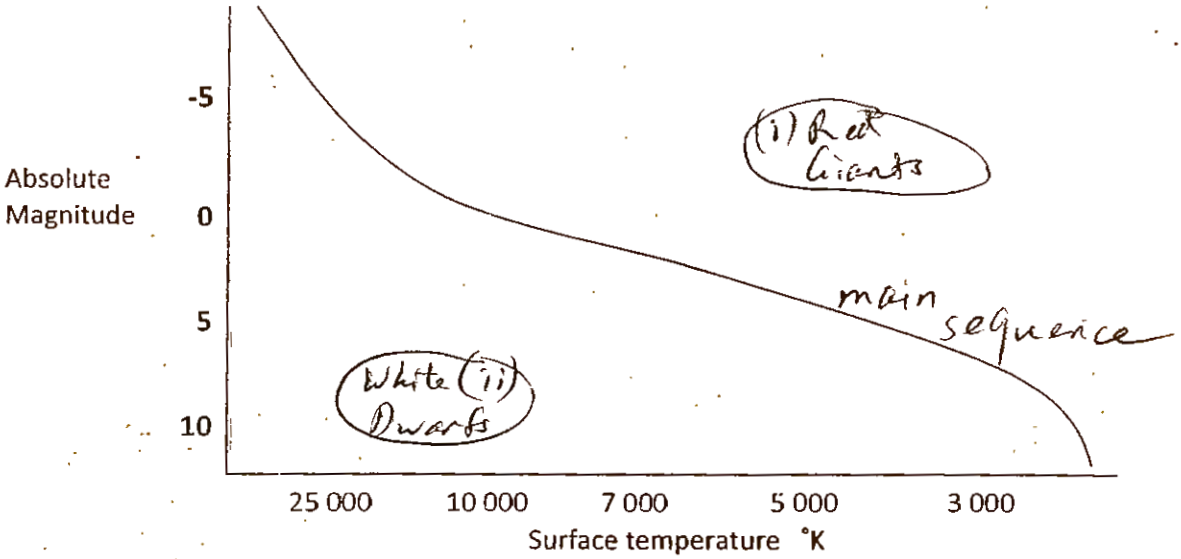
$326.7\,Ws = 326.7\,Ws \times \frac{1\,kW}{1000\,W} \times \frac{1\,h}{3600\,s}$

$= 9.075 \times 10^{-5}\,kWh$

$= 9.1 \times 10^{-5}\,kWh$ to 2 sig figs

Question 31 (5 marks)

Below is a partial HR diagram



(a) Label the plotted line on the graph and add in and label the star groups that represent 3

(i) the next stage in the life of a star the size of our Sun

(ii) the final stage in the life of a star the size of our Sun

(b) Identify an alternate label for the horizontal axis. 1

Spectral Class OR Colour

(c) Identify an alternate label for the vertical axis. 1

Luminosity

End of Section II
End of Paper