VCE PHYSICS 2012

YEAR 11 TRIAL EXAM UNIT 1

Reading Time: 15 minutes　　　　Writing Time: 1h 30m

Structure of Booklet

Section	No of Questions	No of Questions to be answered	No of Marks
A. Core Area of Study			
1. Nuclear Physics & Radioactivity	16	16	30
2. Electricity	15	15	30
B. Detailed Study			
1. Astronomy	10	10	
2. Astrophysics	10	10	20
3. Energy from the Nucleus	10	10	
4. Medical Physics	10	10	
		Total Marks	**80**

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, up to two pages (one A4 sheet) of pre-written notes (typed or handwritten) and a scientific calculator. Students are not permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials Supplied

Question and answers booklet with detachable data sheet.

Instructions

Detach the data sheet during reading time.

Write your name in the space provided.

Answer all questions in the question and answers booklet when indicated.

Also show your workings where space is provided.

Where an answer box has a unit printed in it, give your answer in that unit.

All responses must be in English.

Students are not permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

- **Biology** • **Physics** • **Chemistry** • **Psychology**

Data Sheet VCE Physics 2012 Year 11 Trial Exam Unit 1

Core: Nuclear Physics and Radioactivity

1	absorbed dose	$absorbed\ dose\,(Gy) = \dfrac{energy\ absorbed\,(J)}{mass\,(kg)}$
2	dose equivalent	$dose\ equivalent\ (Sv)\ =\ absorbed\ dose\ (Gy)\ \times\ quality\ factor$

Area of Study 1: Electricity

1	potential difference; power	$V = RI$; $P = VI$
2	resistors in series	$R_T = R_1 + R_2$
3	resistors in parallel	$\dfrac{1}{R_T} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$
4	charge on the electron	$q = -1.6 \times 10^{-19}\ C$
5	speed of light in vacuo	$3.0 \times 10^8\ m\,s^{-1}$
6	acceleration due to gravity near the Earth's surface	$10\ m\,s^{-2}$

Detailed Study 2: Astrophysics

1	astronomical unit	$1.5 \times 10^{11}\ m$
2	parsec	$3.1 \times 10^{16}\ m$
3	light year	$9.5 \times 10^{15}\ m$
4	Hubble constant (H_0)	$74\ km\,s^{-1}\,Mpc^{-1}$ $H_0 = \dfrac{v}{d}$
5	spectrum wavelength shift	$\dfrac{\Delta\lambda}{\lambda} = -\dfrac{v}{c}$
6	distance, d (pc) in terms of a subtended angle in arcseconds (p)	$d = \dfrac{1}{p}$ parsecs
7	luminosity; intensity	$L = I \times 4\pi \times R^2$

Detailed Study 3: Energy from the Nucleus

1	energy and mass	$E = mc^2$
2	1 atomic mass unit	$1.7 \times 10^{-27}\ kg$
3	speed of light in a vacuum	$3.0 \times 10^8\ m\,s^{-1}$

Prefixes / Units

p = pico $= 10^{-12}$

n = nano $= 10^{-9}$

μ = micro $= 10^{-6}$

m = milli $= 10^{-3}$

k = kilo $= 10^{3}$

M = mega $= 10^{6}$

G = giga $= 10^{9}$

1 tonne $= 10^{3}$ kg

Student Name....………………….........................

VCE Physics 2012 Year 11 Trial Exam Unit 1

Student Answer Sheet
Instructions for completing test. Use only a 2B pencil. If you make a mistake, erase and enter the correct answer. Choose *one* only of the four Detailed Studies. Each question is worth **2 marks**. Marks will not be deducted for incorrect answers.

Write your answers to the Short Answer Section in the space provided directly below the question. There are 10 Multiple Choice questions per detailed study to be answered by circling the correct letter in the table below.

SECTION B   Detailed Study 3.1 – Astronomy

Question 1	A	B	C	D	Question 2	A	B	C	D
Question 3	A	B	C	D	Question 4	A	B	C	D
Question 5	A	B	C	D	Question 6	A	B	C	D
Question 7	A	B	C	D	Question 8	A	B	C	D
Question 9	A	B	C	D	Question 10	A	B	C	D

SECTION B: Detailed Study 3.2 –Astrophysics

Question 1	A	B	C	D	Question 2	A	B	C	D
Question 3	A	B	C	D	Question 4	A	B	C	D
Question 5	A	B	C	D	Question 6	A	B	C	D
Question 7	A	B	C	D	Question 8	A	B	C	D
Question 9	A	B	C	D	Question 10	A	B	C	D

SECTION B: Detailed Study 3.3 – Energy from the Nucleus

Question 1	A	B	C	D	Question 2	A	B	C	D
Question 3	A	B	C	D	Question 4	A	B	C	D
Question 5	A	B	C	D	Question 6	A	B	C	D
Question 7	A	B	C	D	Question 8	A	B	C	D
Question 9	A	B	C	D	Question 10	A	B	C	D

SECTION B: Detailed Study 3.6 – Medical Physics

Question 1	A	B	C	D	Question 2	A	B	C	D
Question 3	A	B	C	D	Question 4	A	B	C	D
Question 5	A	B	C	D	Question 6	A	B	C	D
Question 7	A	B	C	D	Question 8	A	B	C	D
Question 9	A	B	C	D	Question 10	A	B	C	D

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION A – Core

Area of Study

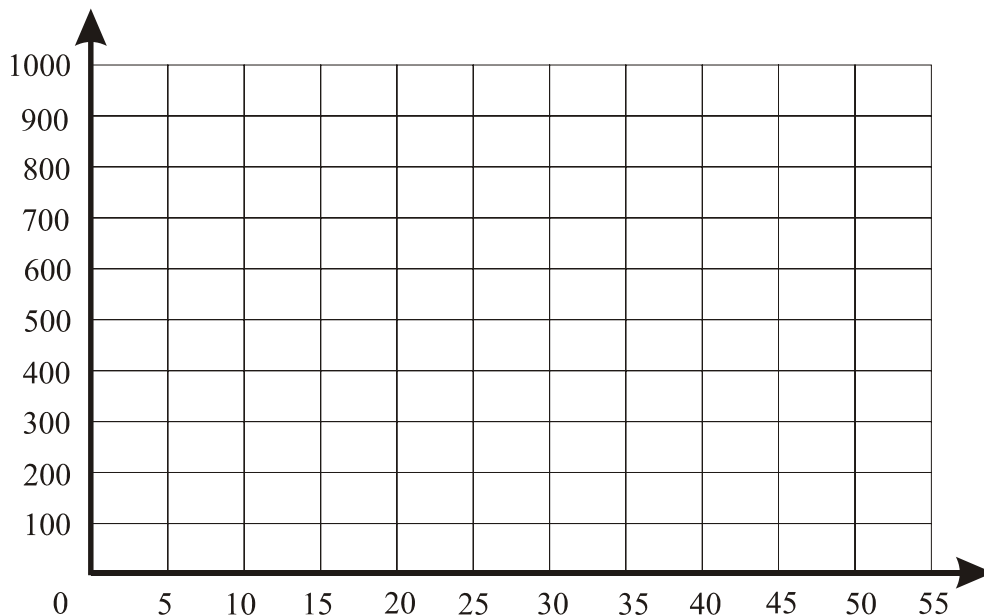## Area of Study 1- Nuclear Physics & Radioactivity

Use the following to answer Questions 1-3.
A radioactive isotope is monitored using a Geiger counter. The following information is collected.

Count rate (Bq)	1000	900	600	300	150
Time (mins)	0	5	15	35	55

Question 1

Plot the graph of count rate versus time using **Graph 1**, below, carefully sketching line of best fit.

Graph 1

(2 marks)

Question 2
Using your **Graph 1**, determine the half-life of the sample.

min

(1 mark)

Question 3
Determine the time when only 12.5% of the original sample will remain.

min

(2 marks)

Question 4
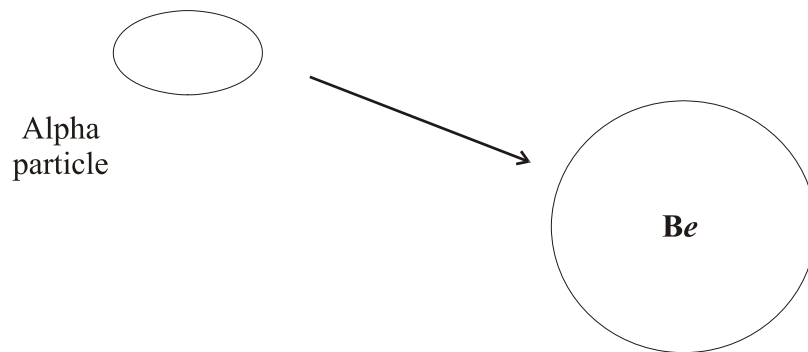Explain what is meant by the term transmutation in nuclear physics.

_____

_____

_____

_____
(2 marks)

The following information relates to Question 5.
The production of neutrons can be achieved by bombarding stable beryllium nuclei with alpha particles as in **Figure 1**.

Alpha
particle

B*e*

Figure 1

Question 5
Write the nuclear equation for the event in **Figure 1**.

(2 marks)

The following information relates to Questions 6-7
A common practical experiment in Year 11 Physics is to measure the count rate of various isotopes and to place shielding between the element and the isotope and to make conclusions about the type of emissions from the isotopes.

Geiger counter   Shielding   Radioactive source
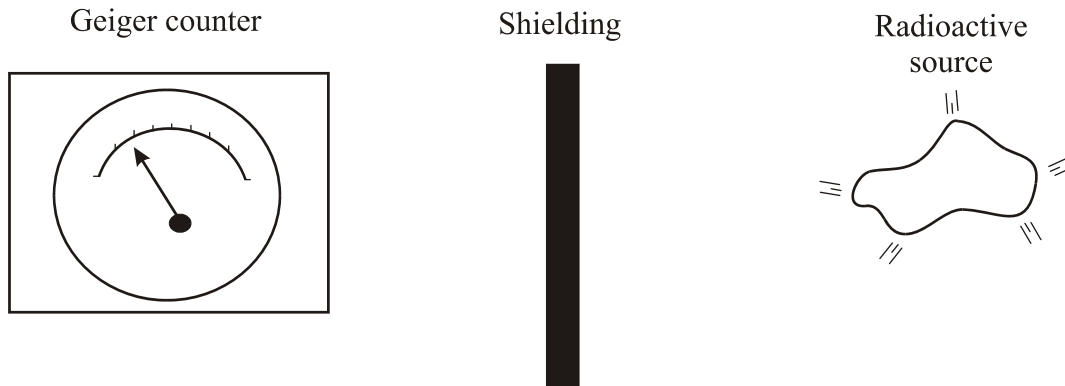
Figure 2

A radioactive source was placed in the position shown in **Figure 2**. A student measured the decay rate without shielding and again with shielding.

Question 6
If only a piece of paper was used as the shielding, the student noticed a large drop in the reading on the Geiger counter.
What can be concluded about this radioactive source?

_____

_____

_____
                                                                     (2 marks)

Question 7
The radioactive source was swapped for another and the shielding was changed to 1 mm of aluminium. The student noticed a large drop in the reading on the Geiger counter.
What can be concluded about this radioactive source?

_____

_____

_____

_____
                                                                     (2 marks)

The following information relates to Questions 8-9.
Two of the isotopes of the element of atomic number 10 have mass numbers of 20 and 22.

Question 8
How many protons in each isotope?

_____

_____

_____
(2 marks)

Question 9
How many nucleons in each isotope?

_____

_____

_____
(2 marks)

Question 10
Place the three decay types, alpha, beta, gamma, in order of their ionising ability, from least ionising to most ionising.

_____

_____

_____
(2 marks)

The following information relates to Questions 11-13.
Some cancers can be treated by applying a radioactive source into the tumour site. A 20 gram cancer tumour absorbs 0.0030 J of energy from such a source.

Question 11
Calculate the absorbed dose for the 20g tumour.

Gy

(2 marks)

Question 12
Calculate the dose equivalent (in mSV) if the radiation source is a gamma emitter.

mSV

(2 marks)

Question 13
Calculate the dose equivalent if the radiation source is an alpha emitter.

Sv

(2 marks)

Question 14
Describe some of the somatic effects of radiation exposure.

_____

_____

_____

_____

(2 marks)

Question 15
What would be the average annual background dose equivalent for a student in Melbourne?
A.   2.0 mSv
B.   2.0 Sv
C.   10 Sv
D.   0.01Sv

Sv

(1 mark)

Question 16
The Large Hadron Collider in Europe collides sub atomic particles to search for the Higgs-Boson field. The total collision energy is 14 TeV.
Determine the total collision energy in joules.

J

(2 marks)

## End of Area of Study 1

Area of Study 2- Electricity

Question 1
How many coulombs of charge will pass through a given point in a wire in 20 seconds, if the wire has a current of 5.0 MA flowing through it?

(2 marks)

	C

The following information relates to Question 2.
A battery of e.m.f. *E* is connected to three identical resistors, each of resistance *R*, a voltmeter and a switch, as shown in **Figure 1**.
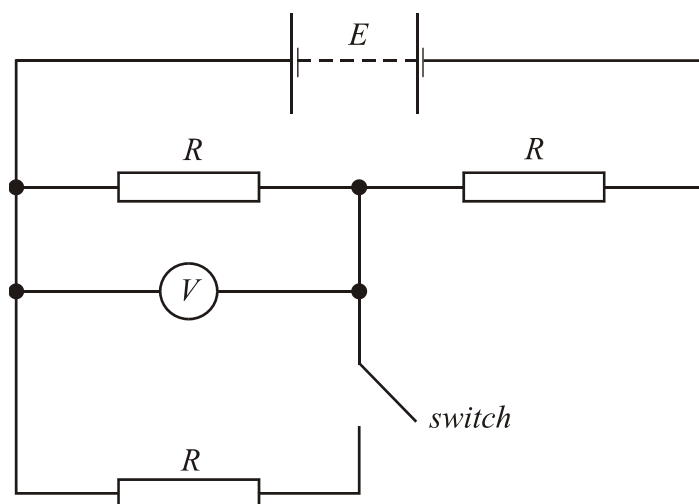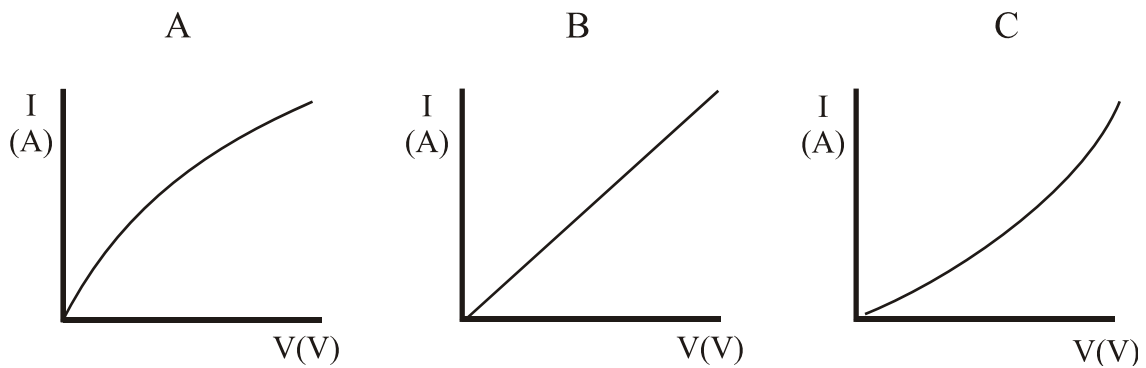

Figure 1

Question 2
The readings on the voltmeter when the switch is open and when it is closed are correctly given by which of the options A-D?

	Switch open	**Switch closed**
A.	0	Less than ½ *E*
B.	0	½ *E*
C.	½ *E*	Less than ½ *E*
D.	½ *E*	½ *E*

(2 marks)

The following information relates to Questions 3 and 4. The I-V characteristic of three different electric devices are shown below.

A B C

Figure 2

Question 3
Which one of the graphs in **Figure 2** obeys Ohm's Law?
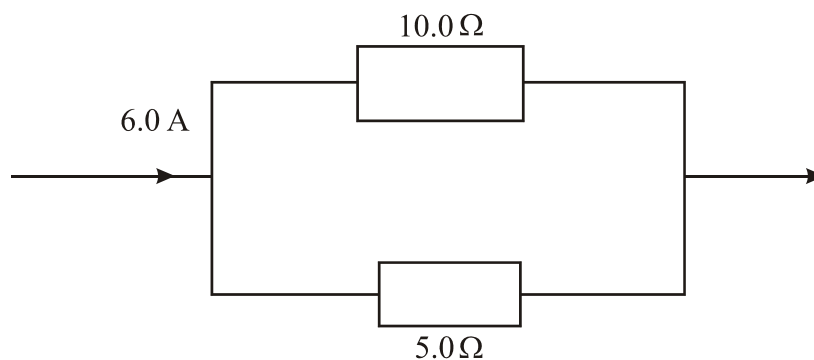
A B C *circle correct answer.*

(1 mark)

Question 4
Which graph/s in **Figure 2** best represent the characteristic of a diode?

A B C *circle correct answer/s*

(1 mark)

*The circuit shown in **Figure 3** relates to Question 5 and 6.*

10.0 Ω

6.0 A

5.0 Ω

Figure 3

Question 5
Calculate the total resistance of the circuit in **Figure 3.**

Ω

(2 marks)

Question 6
Determine the current flowing through each resistor.

| 10.0 Ω   A |

| 5.0 Ω   A |

(2 marks)

Question 7
A student is given three resistors of 4.7k Ω each. Explain the best way to connect them to achieve the highest resistance. Show your calculations.

_____

_____

_____

_____

(2 marks)

Question 8
Many expensive cars have washer and wipers for the front lights. One 60 W washer draws a current of 5.0 A from the battery. Calculate the resistance of the washer.

| Ω |

(2 marks)

The following information relates to Questions 9 and 10.
A student's old computer draws 2.0 A of current when connected to a 240 V supply.
Question 9
 What is the power rating of the television set?

| W |

(2 marks)

Question 10
The computer is used for 4 hours a day for 1 week. How much will the consumer be charged at a rate of 20.44 cents per kilowatt-hour?

| $ |

(4 marks)

Question 11

A student uses a 600 W hair dryer to dry her hair. She notices that the plug only has two pins. Why doesn't it need an earth pin?

_____

_____

_____

(2 marks)

Question 12

Explain why some people may survive an electric shock of 240 V when standing on carpet whereas standing barefoot on wet grass is likely to be lethal.

_____

_____

_____

(2 marks)

Question 13

Many trades people use electric tools outside. What safety precautions should they take when using tools outside?
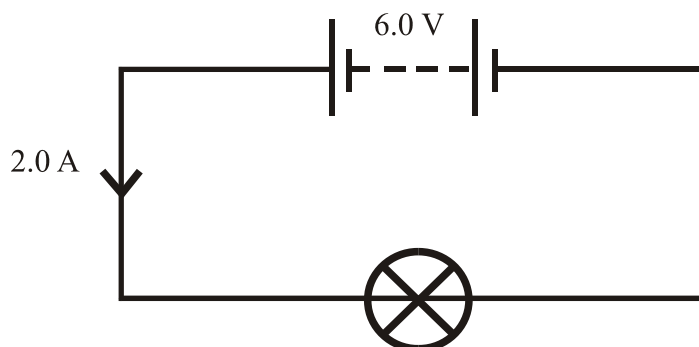
_____

_____

_____

(2 marks)

Question 14

A 1200 W electric toaster operates from the 240 V mains. Calculate the resistance of the heating element of the toaster under operating conditions.

Ω

(2 marks)

A 6.0 V battery is connected to a filament lamp as shown in **Figure 4**. The current flowing through the lamp is 2.0 A.

Figure 4

Question 15
Calculate how much electrical energy, in kJ, is transferred to the filament when the battery is connected for 2.0 minutes.

	kJ

(2 marks)

End of Area of Study 2

End of Section A

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Detailed Studies

Detailed Study 3.1 – Astronomy

Detailed Study 3.2 – Astrophysics

Detailed Study 3.3 – Energy from the Nucleus

Detailed Study 3.6 – Medical Physics

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Detailed Study 3.1 – Astronomy

Question 1
Positions in the sky of celestial objects can be stated in terms of right ascension and declination.
Which alternative is ***not*** a correct statement?
A.   The declination coordinate is directly analogous to latitude here on Earth.
B.   The declination of an object indicates how far east or west of the celestial equator it lies.
C.   The right ascension coordinate is analogous to longitude here on Earth.
D.   The right ascension of an object indicates its angular distance from the Vernal equinox.

Question 2
Choose the alternative that makes the statement ***incorrect***.
Diurnal motion is the daily motion of stars and other celestial bodies across the sky
A.   that is due to the Earth's rotation from west to east.
B.   that causes celestial bodies to have an apparent motion from east to west.
C.   and a long-exposure photograph shows diurnal motion as 'star trails'.
D.   from north to south once each year.

Question 3
In astronomy, a telescope is usually used to collect and focus electromagnetic radiation from nearby and distant sources. One such type of telescope detects very short wavelength electromagnetic radiation from an orbit outside the Earth's atmosphere. This type of telescope is known as
A.   a reflecting telescope.
B.   a radio telescope.
C.   a gamma ray telescope.
D.   a refracting telescope.

Question 4

Figure 1 shows Ptolemy's ideas of the universe, which were that all motion in the heavens is circular, heavenly objects were made from perfect material and the Earth was at the centre of the universe.

Sun
Venus
Mercury
Moon
Earth
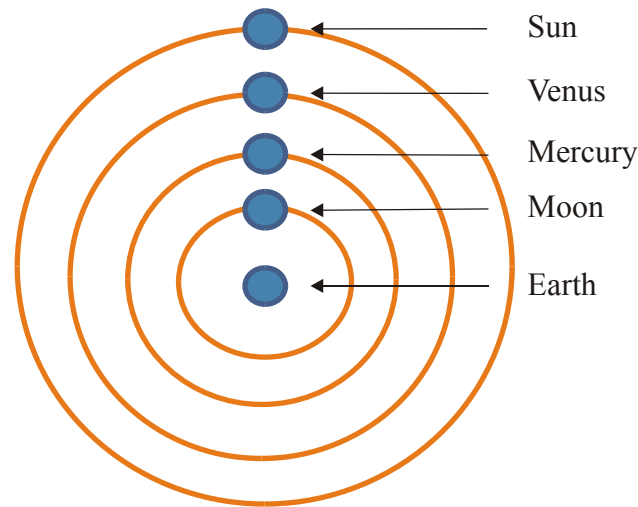
Figure 1

This idea of the structure of the universe, is known as the
A.   geocentric model.
B.   heliocentric model.
C.   solar system model.
D.   retrograde model.

Question 5

Mars, Jupiter and Saturn every so often appear to move across the sky in one direction and then seem to stop and go in the opposite direction. This behaviour of the planets occurs because
A.   the planets have retrograde motion, and orbit in the opposite direction.
B.   the Earth moves in the opposite direction to these planets at various times.
C.   of the different orbital speeds of the planets.
D.   the motion of these planets is epicyclic.

Question 6

Which one of the systems listed below resolved problems such as the apparent yearly motions of the stars and Sun, the apparent retrograde motions of Mars, Jupiter and Saturn, and the fact that Mercury and Venus never travel more than a certain distance from the Sun?
A.   Geocentric system.
B.   Heliocentric system.
C.   Aristotelian system.
D.   Ptolemaic system.

Question 7
Which one of the following discoveries was **not** made by Galileo using his telescope?
A.   Venus shows phases just like the Moon.
B.   Blemish-like features on the surface of Venus.
C.   Spots on the Sun.
D.   The four large moons of Jupiter.

Question 8
Chandra is an example of an X-ray telescope and needs to be situated above the Earth's atmosphere to operate successfully. The reason for this is
A.   X-ray radiation cannot penetrate the Earth's atmosphere.
B.   X-ray radiation is too weak and the telescope must be closer to the source.
C.   X-rays ionise the atmosphere and cause distortion of the signal on the ground.
D.   X-ray radiation is of long wavelength and cannot penetrate the Earth's atmosphere.

Question 9
Telescopes positioned in orbit above the Earth's atmosphere gain a clear view of celestial objects.   Which one of the following choices is **not** an advantage of space telescopes such as the Hubble Space telescope?
A.   They can be programmed to function continuously.
B.   They can detect light that would otherwise be blocked by the atmosphere.
C.   They are unaffected by weather.
D.   They are closer to celestial objects they are observing.

Question 10
Which one of the following statements is **incorrect**?
Compared with optical reflecting telescopes, radio telescopes
A.   have a similar structure, in that a concave reflecting surface is employed.
B.   have a much lower resolving power.
C.   are not as affected by the atmosphere and so their positioning on Earth is less critical.
D.   can only operate in the ultra violet wavelength region of the electromagnetic spectrum.

End of Detailed Study

End of Trial Exam

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

> *Instructions for Section B*
> Answer **all** questions from the Detailed study, in pencil, on the answer sheet provided for multiple choice questions.
> Choose the response that is **correct** or that **best answers** the question and **circle the letter** on the multiple-choice answer sheet.
> A correct answer scores 2, an incorrect answer scores 0.
> Marks will **not** be deducted for incorrect answers.
> No marks will be awarded if more than one answer is given for any question.

Detailed Study 3.2 – Astrophysics

Question 1
In which one of the following alternatives is energy released by the fusion of hydrogen atoms to form helium?
A.   In a nuclear power station.
B.   In a radioactive isotope.
C.   In the core of the Earth.
D.   In the core of the Sun.

Question 2
Red shift is caused by
A.   electromagnetic waves changing speed as they travel from distant sources.
B.   an observed decrease in the frequencies of the electromagnetic radiation leaving the source.
C.   movement of the Earth in its orbit around the Sun.
D.   an observed decrease in the wavelength of the electromagnetic radiation leaving the source.

Question 3
A star has a measured light intensity of 1370 W m^{-2} and is known to be 1.49×10^{11} m from Earth. The luminosity of the star is
A. 3.8×10^{26} W
B. 1.9×10^{14} W
C. 1.1×10^{8} W
D. 2.6×10^{15} W

Question 4

A certain star has a parallax angle of 0.258 arcsec. The distance of the star from Earth is

A. 3.9 pc
B. 3.9 ly
C. 3.9 AU
D. 9.5×10^{15} km

Question 5

Which one of the following is the correct flowchart of stellar evolution for stars like the Sun?

A. main sequence red giant protostar white dwarf
B. red giant white dwarf main sequence protostar
C. protostar main sequence red giant white dwarf
D. white dwarf main sequence protostar red giant

Question 6

A distant galaxy is receding from Earth with a speed of 7.0×10^3 km s^{-1}. Using this information and the Hubble constant, 70 km s^{-1} Mpc, the distance of this galaxy from Earth is

A. 4.9×10^2 Mpc
B. 100 pc
C. 4.9×10^{18} km
D. 100 Mpc

Question 7

Scientists who have studied electromagnetic radiation from distant galaxies support the 'big bang' theory, which states that the Universe began

A. in many places at the same time.
B. from a very small point.
C. as one very big galaxy.
D. as one very big solar system.

Question 8

Which one of the following properties of a star *cannot* be deduced from its spectrum?

A. Motion in space.
B. Temperature.
C. Chemical composition.
D. Parallax shift.

Question 9
Figure 1 shows the basic geometry for one method of measuring stellar distances.
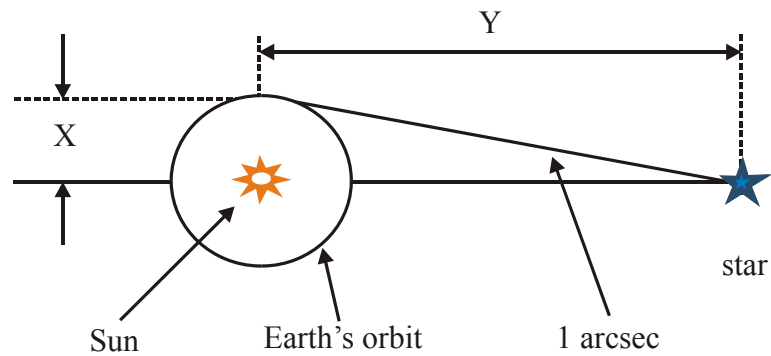
Figure 1

From **Figure 1**,
A.   Measurement Y represents one parsec.
B.   Measurement X is one ly.
C.   Measurement Y represents one ly.
D.   Measurement X represents one parsec.

Question 10
Which one of the following alternatives best describes the Hertzsprung-Russell diagram?
A.   A graph of apparent magnitudes of stars against their temperature.
B.   A graph of luminosity of stars against their spectral types.
C.   A graph of temperature of stars against their spectral types.
D.   A graph of absolute magnitude of a star against their luminosity.

End of Detailed Study

End of Trial Exam

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

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Detailed Study 3.3 – Energy from the Nucleus

Question 1
An atom of the element lithium has a nucleon number of 7 and a proton number of 3.
From the alternatives A – D, which diagram represents a neutral atom of lithium?
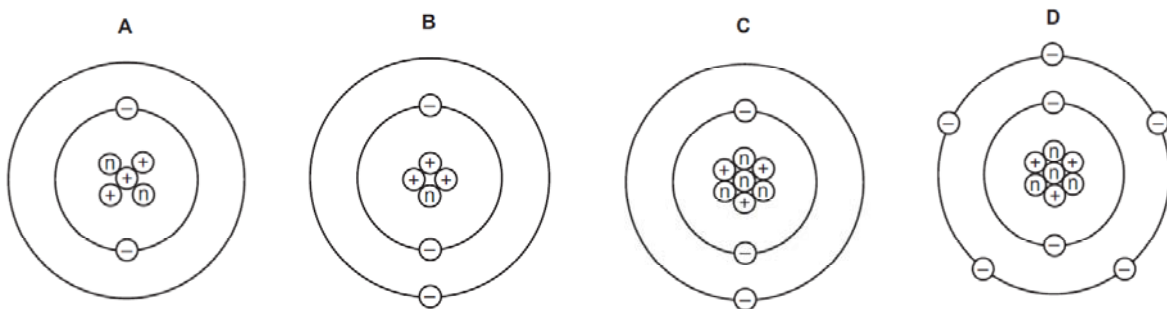
A.   A
B.   B
C.   C
D.   D

Question 2
If 1.0 g of matter is completely transformed into energy, how much energy is released?
A. 9.0×10^{13} J
B. 9.0×10^{16} J
C. 5.6×10^{23} J
D. 5.6×10^{26} J

Question 3

Which one of the conditions is **_not_** necessary to sustain a fission chain reaction?

A.   A high proportion of fissile uranium-235.

B.   A temperature in excess of 20 million degrees.

C.   A critical mass of fuel.

D.   A suitable shape of fuel.

Question 4

A nucleus of $^{235}_{92}U$ absorbs a neutron. **Figure 1** shows what can happen when the nucleus of a uranium atom absorbs a neutron.

Figure 1

The name given to the process shown in **Figure 1** is

A.   nuclear fusion.

B.   nuclear fission.

C.   moderation.

D.   initiation.

Question 5

The process shown in **Figure 1** could lead to a chain reaction because

A.   the neutrons released can cause other atoms to fuse and produce energy.
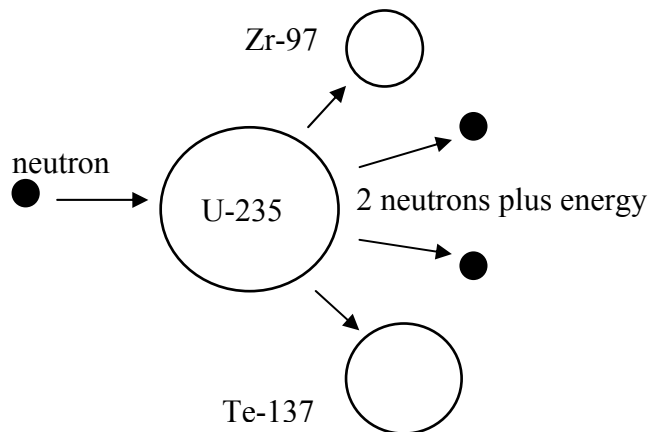
B.   the fragments from the reaction have enough kinetic energy to cause more nuclear disintegration.

C.   the neutrons go from one atom to the next in the form of a chain reaction.

D.   released neutrons from one disintegration can be absorbed by other uranium nuclei that fission, which then causes further neutron release.

Question 6

$^{235}_{92}U$ is a naturally occurring isotope of uranium and can produce a number of different products when it absorbs a slow moving neutron.

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{236}_{92}U \rightarrow {}^{148}_{57}La + {}^{85}_{a}Br + b\,{}^{1}_{0}n + energy$$
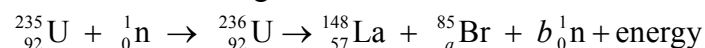
The two quantities, a and b, are respectively

A.   3, 35

B.   35, 1

C.   35, 3

D.   1, 35

Question 7
Which one of the following statements is *incorrect*?
A.   Electrostatic forces are responsible for chemical reactions.
B.   The weak nuclear force is responsible for beta particle emission.
C.   The gravity force is responsible for attraction between objects.
D.   The strong nuclear force is responsible for holding the nuclear particles together.

Question 8
What happens to the atomic number and mass number of an atom when it undergoes β^- decay?
A.   The atomic number deceases by one and the mass number remains constant.
B.   The atomic number decreases by two and the mass number decreases by four.
C.   The atomic number increases by one and the mass number remains constant.
D.   The atomic number decreases by two and the mass number remains constant.

Question 9
Plutonium-239 is formed in nuclear reactors when uranium-238 absorbs a neutron and then undergoes two beta decays. The correct nuclear equation for this reaction is
A. $^{238}_{92}\text{U} + ^{1}_{0}\text{n} \rightarrow ^{239}_{92}\text{U} \rightarrow ^{239}_{93}\text{Np} + ^{0}_{-1}\text{e}$

$^{239}_{93}\text{Np} \rightarrow ^{239}_{94}\text{Pu} + ^{0}_{-1}\text{e}$
B. $^{238}_{92}\text{U} + ^{1}_{0}\text{n} \rightarrow ^{239}_{92}\text{U} \rightarrow ^{239}_{93}\text{Np} + ^{4}_{2}\text{He}$

$^{239}_{93}\text{Np} \rightarrow ^{239}_{94}\text{Pu} + ^{4}_{2}\text{He}$
C. $^{238}_{92}\text{U} + ^{1}_{0}\text{n} \rightarrow ^{239}_{92}\text{U} \rightarrow ^{239}_{93}\text{Np} + 2\,^{0}_{-1}\text{e}$
D. $^{238}_{92}\text{U} + ^{1}_{0}\text{n} \rightarrow ^{239}_{93}\text{Np} + 2\,^{0}_{-1}\text{e}$

Question 10
The problem with nuclear fusion is that very high temperatures are needed. This is because
A.   very large currents are needed to make fusion occur.
B.   very powerful magnetic fields are needed for fusion to occur.
C.   the energy has to be high enough for nuclei to overcome the repulsive electrostatic force.
D.   the energy has to be high enough for nuclei to overcome the strong nuclear force.

End of Detailed Study

End of Trial Exam

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

> *Instructions for Section B*
> Answer **all** questions from the Detailed study, in pencil, on the answer sheet provided for multiple choice questions.
> Choose the response that is **correct** or that **best answers** the question and **circle the letter** on the multiple-choice answer sheet.
> A correct answer scores 2, an incorrect answer scores 0.
> Marks will **not** be deducted for incorrect answers.
> No marks will be awarded if more than one answer is given for any question.

Detailed Study 3.6 – Medical Physics

Question 1
Endoscopes contain optical fibres and are frequently used to view inside the body.
Optical fibres can bend light around corners without loss of signal. This is because
A.   absorption of the signal occurs in the optical fibre.
B.   light signals are digital signals.
C.   reflection of the signal occurs inside the optical fibre.
D.   following signals push the signals around the corners.

Question 2
The table shows the properties of four radioactive isotopes.

isotope	type of radiation emitted	half-life
Californium-241	Alpha	4 minutes
Cobalt-60	Gamma	5 years
Strontium-90	Beta	28 years
Technetium-99	Gamma	6 hours

Which isotope would be the best to use as an external treatment of a tumour in the human body?
A.   Californium-241
B.   Cobalt-60
C.   Strontium-90
D.   Technetium-99

Question 3
Not all radioisotopes are suitable for use as tracers. The type of radiation that a tracer should emit is
A.   soft gamma radiation.
B.   soft X-rays.
C.   alpha particles.
D.   beta particles.

Question 4
Medical X-rays can sometimes be dangerous because
A.   they can pass through the body.
B.   they cause ionisation inside cells.
C.   they cause burns to the skin.
D.   they cause water inside cells to heat up.

Question 5
Radioisotopes can be used in the treatment of tumours by implanting the radioisotope or by using an external source to irradiate the tumour. Radioisotopes used as *implants* usually emit
A.   alpha or beta.
B.   gamma.
C.   X-rays.
D.   infra-red radiation.

Question 6
If an external radioactive source is used to irradiate a patient's tumour, the source is rotated around the body as shown in **Figure 1**.
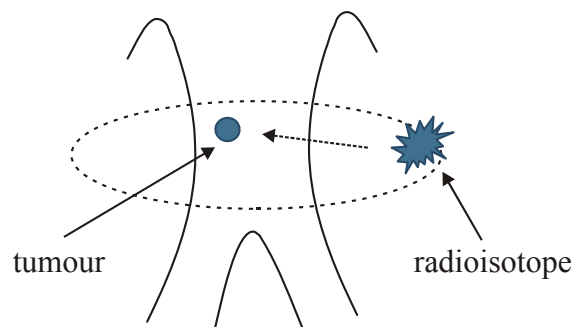
Figure 1

The reason why the radioisotope is rotated around the body is because
A.   parts of the abdomen are too dense for the radiation to penetrate and reach the tumour.
B.   there may be skeletal tissue blocking the radiation.
C.   the tumour is attacked from a number of directions which is more effective treatment.
D.   it is too difficult to locate the exact position of the tumour.

Question 7
Lasers have many uses in medicine. For some applications the laser light is transmitted through the air. For other applications the laser light is transmitted along optical fibres. Choose the alternative that makes the statement ***incorrect***.
Laser light is transmitted through the air to treat
A.   a detached retina in the eye.
B.   a stomach ulcer.
C.   skin blemishes.
D.   cancerous and pre-cancerous cells.

Question 8
Choose the alternative that makes the statement ***correct***.
Laser light is transmitted along optical fibres to treat
A.   a detached retina in the eye.
B.   and cauterise a wound to prevent infection.
C.   skin blemishes.
D.   stomach ulcers.

Question 9
Ultrasound imaging, also called ultrasound scanning, involves
A.   exposing part of the body to high-frequency sound waves to produce pictures of the inside of the body.
B.   an examination of the body using ionising radiation similar to X-rays.
C.   an invasive medical test that helps physicians diagnose and treat medical conditions.
D.   an ideal imaging technique for the bowel or organs obscured by the bowel.

Question 10
Positron emission tomography, also called PET imaging or a PET scan, is a type of nuclear medicine imaging. Choose the alternative that makes the statement ***incorrect***.
PET and PET/CT scans are performed to
A.   detect cancer.
B.   evaluate brain abnormalities, such as tumours, memory disorders and seizures and other central nervous system disorders.
C.   determine the effects of a heart attack.
D.   expose parts of the body to beta particle radiation to produce images of internal organs.

End of Detailed Study

End of Trial Exam

Suggested Answers

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION A – Core

Questions	Area of Study 1 – Nuclear Physics and Radioactivity	Mark Allocation
1		1 mark for correct axis and for correct labelling 1 mark for curve
2	From graph approximately 20 minutes, activity halves every minute.	1
3	100% → 50% → 25% i.e. 3 half lives so approximately 60 minutes.	1 1
4	The changing of one element into another by changing or altering the nuclear structure of the original element	1 1
5	$$^{9}_{4}Be \ + \ ^{4}_{2}He \longrightarrow \ ^{12}_{6}C \ + \ ^{1}_{n}0$$	2
6	It is an alpha emitter.	2
7	Most likely to be an alpha or beta emitter.	2
8	10.	2
9	20 and 22 nucleons.	2
10	Gamma, beta, alpha.	2

11	Absorbed dose = energy absorbed (J)/mass of tissue (kg) = 0.0030/0.020 =0.15 Gy	1 1
12	Dose Eq = AD x QF 0.15 x 1 = 0.15 Sv = 150 m Sv	 1 1
13	Dose Eq = AD x QF 0.15 x 20 = 3.0 Sv	1 1
14	Short term effects of radiation, e.g. nausea, diarrhoea, hair loss, bone marrow damage, death.	2
15	2.0 mSv	1
16	1 eV = 1.6 x 10 $^{-19}$ J 14 x 10 ^{12} x 1.6 x 10 $^{-19}$ =2.24 x 10 $^{-6}$ J	1 1

Questions	Area of Study 2 - Electricity	Mark Allocation
1	Q= It = 0.0050 x 20 = 0.010 C	 1 1
2	Answer: C Switch open: equal p.d. of ½ E across each resistor in series. Switch closed: the p.d. across the parallel connection will have less resistance than R so the p.d. is less than ½ E.	2
3	Linear behaviour so B.	1
4	Voltage controlling so C.	1
5	1/Rt = 1/10 + 1/5 Rt = 3.3Ω	1 1
6	2.0 A in 10 ohm resistor, 4.0 A in 5 Ω. Current splits in ratio 10 : 5 = 2:1	1 1
7	The greatest resistance is when they are combined in series. Therefore R_1 = 4.7 x 3 = 14.1 k Ω	1 1
8	P=VI P=12 x 5 = 60W P = I^{2}R 60 = 5.0^2 X R R = 2.4 Ω	 1 1

9	P=VI =240 x 2 =480 W	1 1
10	4 hours x 7 = 28 hours 0.480 kW x 28 = 13.44 kWh 13.44 x 20.44 = \$2.75	1 1 1 1
11	The plug only has two pins i.e. no earth wire, because the case of the hair dryer is plastic.	2
12	More resistance when standing on carpet, so smaller current flows through the body.	1 1
13	Don't work in wet weather, ensure that there is good ground contact.	1 1
14	Use; $$P = \frac{V^2}{R}$$ $$R = \frac{240 \times 240}{1200}$$ $$= 48 \ \Omega$$	1 1
15	2 minutes is 120 seconds. Energy $= VI\Delta t = 6.0 \text{ V} \times 2.0 \text{ A} \times 120 \text{ s} = 1440 \text{ J}$ $= 1.44 \times 10^3 \text{ J}$ 1.44kJ	1 1

End of Suggested Answers – Section A

Suggested Answers

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Question	Answer	Detailed Study: 3.1 – Astronomy
1	B	The declination of an object indicates how far <u>north or south</u> of the celestial equator it lies.
2	D	Alternative D is incorrect.
3	C	Gamma ray telescopes detect short wavelength radiation from orbit.
4	A	The geocentric model places Earth at the centre of the system.
5	C	The different orbital speeds of the planets cause retrograde motion.
6	B	Heliocentric system.
7	B	Features on the surface of Venus cannot be seen with a telescope.
8	A	X-ray radiation cannot penetrate the Earth's atmosphere.
9	D	They are closer to the celestial objects they are observing.
10	D	Radio telescopes operate in the longer wavelength region of the electromagnetic spectrum.

End of Suggested Answers

Suggested Answers

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Question	Answer	Detailed Study: 3.2 – Astrophysics
1	D	Nuclear fusion occurs in the core of the Sun.
2	B	Red shift is an observed decrease in the frequencies (or increase in wavelength) of the electromagnetic radiation leaving the source.
3	A	Use $L = I \times 4\pi \times R^2$ $= 1370 \times 4\pi \times (1.49 \times 10^{11})^2$ $= 3.8 \times 10^{26}$ W
4	A	Use; $d = \dfrac{1}{p}$ $= \dfrac{1}{0.258}$ $= 3.9$ pc
5	C	protostar main sequence red giant white dwarf
6	D	Use; $d = \dfrac{v}{H_0}$ $= \dfrac{7000}{70}$ $= 100$ MPc
7	B	The origin of the Universe stems from a very small point.
8	D	Parallax shift is not related to spectrum analysis.
9	A	Measurement Y represents one parsec.
10	B	H-R diagrams graph luminosity of stars against their spectral types.

End of Suggested Answers

Suggested Answers

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Question	Answer	Detailed Study: 3.3 – Energy from the Nucleus
1	C	Li: 3 p, 4 n, 3 electrons
2	A	Use $$E = mc^2$$ $$= \frac{1}{1000} \times (3.0 \times 10^8)^2$$ $$= 9.0 \times 10^{13} \text{ J}$$
3	B	A temperature in excess of 20 million degrees is not required.
4	B	Nuclear fission.
5	D	Released neutrons from one disintegration can be absorbed by other uranium nuclei that fission which then causes further neutron release.
6	C	Atomic number = 35; 3 neutrons emitted.
7	A	Electro<u>magnetic</u> forces are responsible for chemical reactions.
8	C	The atomic number increases by one and the mass number remains constant for beta decay.
9	A	$${}^{238}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{239}_{92}\text{U} \rightarrow {}^{239}_{93}\text{Np} + {}^{0}_{-1}\text{e}$$ $${}^{239}_{93}\text{Np} \rightarrow {}^{239}_{94}\text{Pu} + {}^{0}_{-1}\text{e}$$
10	C	For nuclear fusion to occur, the energy has to be high enough for nuclei to overcome the repulsive electrostatic force.

End of Suggested Answers

Suggested Answers

VCE Physics 2012 Year 11 Trial Exam Unit 1

SECTION B – Detailed Study

Question	Answer	Detailed Study: 3.6 – Medical Physics
1	C	Reflection of the signal occurs inside the optical fibre.
2	B	Cobalt-60 emits gamma rays and can penetrate tissue.
3	A	Gamma radiation can penetrate the body and be detected externally.
4	B	X-rays are high energy radiation capable of causing ionisation inside cells.
5	A	Alpha or beta radiation is more localised when implants are used.
6	C	The tumour is more effectively radiated from a number of different directions.
7	B	Lasers are not used to treat stomach ulcers through the air.
8	D	Laser light needs to be channelled by means of optical fibres to treat stomach ulcers.
9	A	Ultrasound involves exposing part of the body to high-frequency sound waves to produce pictures of the inside of the body.
10	D	PET scans do not involve beta particle radiation.

End of Suggested Answers