Neap

Trial Examination 2021

VCE Physics Unit 1

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	10	10	10
B	16	16	80
			Total 90

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, pre-written notes (one folded A3 sheet or two A4 sheets bound together by tape) and one scientific calculator.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question and answer booklet of 19 pages

Formula sheet

Answer sheet for multiple-choice questions

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

You may keep the formula sheet.

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

SECTION A – MULTIPLE-CHOICE QUESTIONS

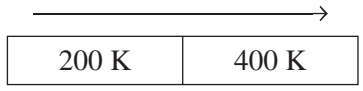
Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
Take the value of g to be 9.8 m s^{-2}.

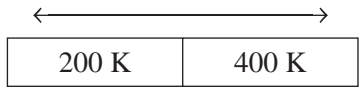
Question 1

Which one of the following diagrams correctly represents the flow of heat?

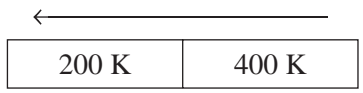
A.



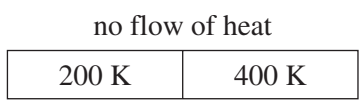
B.



C.



D.



Question 2

A balloon reaches an internal energy of 35 J and expands using 15 J.

What is the heat transfer to the system?

A. –50 J

B. –20 J

C. 20 J

D. 50 J

Question 3

In an experiment, 900 g of aluminium is heated to 90.0°C. It is then dropped into 1.00 L of water with a temperature of 15.0°C.

Data

$C_{aluminium}$	880 J kg^{-1} $°C^{-1}$
C_{water}	4200 J kg^{-1} $°C^{-1}$
density of water	1 g mL^{-1}

The final temperature of the water and aluminium is closest to

A. 27.0°C

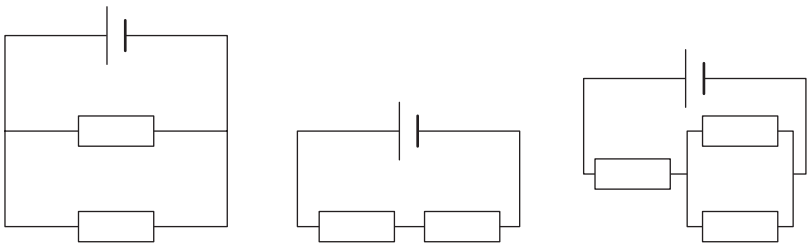
B. 31.0°C

C. 38.0°C

D. 39.0°C

Question 4

In the circuits shown below, each battery is 1.0 V and each resistor is 1.0 Ω.



circuit X circuit Y circuit Z

Which one of the following correctly orders the total power output of the circuits from lowest to highest?

A. X, Y, Z

B. Z, X, Y

C. Y, Z, X

D. Y, X, Z

Question 5

A household uses 4800 W of electric power during the 2-hour period from 6:00 pm to 8:00 pm. The amount of power used is the same every night. The cost of energy is 25.5 cents per kWh.

What is the total cost of energy consumed between 6:00 pm to 8:00 pm over a 2-week period?

A. $2.45

B. $13.44

C. $34.27

D. $134.40

Question 6

Consider the following decay equations.

$$^{233}_{92}\mathrm{U} \rightarrow {}^{229}_{90}\mathrm{Th} + X$$
$$^{202}_{81}\mathrm{Tl} \rightarrow {}^{202}_{81}\mathrm{Tl} + Y$$
$$^{82}_{35}\mathrm{Br} \rightarrow {}^{82}_{36}\mathrm{Kr} + Z$$

X, *Y* and *Z* respectively are

A. alpha, beta, gamma.

B. beta, gamma, alpha.

C. gamma, alpha, beta.

D. alpha, gamma, beta.

Question 7

A 200 W slow cooker and a 500 W kettle are both plugged into a 240 V DC power supply.

When the appliances are compared, the

A. $I_{\text{slow cooker}} > I_{\text{kettle}}$ and the $R_{\text{slow cooker}} > R_{\text{kettle}}$.

B. $I_{\text{slow cooker}} < I_{\text{kettle}}$ and the $R_{\text{slow cooker}} > R_{\text{kettle}}$.

C. $I_{\text{slow cooker}} > I_{\text{kettle}}$ and the $R_{\text{slow cooker}} < R_{\text{kettle}}$.

D. $I_{\text{slow cooker}} < I_{\text{kettle}}$ and the $R_{\text{slow cooker}} < R_{\text{kettle}}$.

Question 8

Two types of quarks and their respective charges are shown below.

Quark	Charge	Symbol
up	$+\frac{2}{3}$	u
down	$-\frac{1}{3}$	d

A quark with the composition up, down, down (*udd*) transforms into a particle with the quark composition up, up, down (*uud*).

The other particle produced in this transformation is

A. a positron.

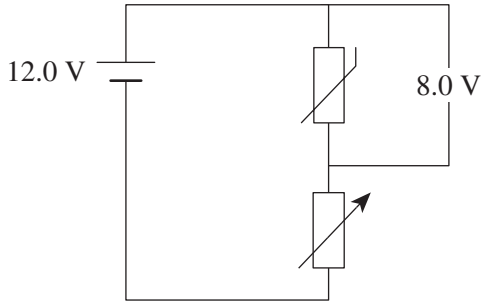
B. an electron.

C. a proton.

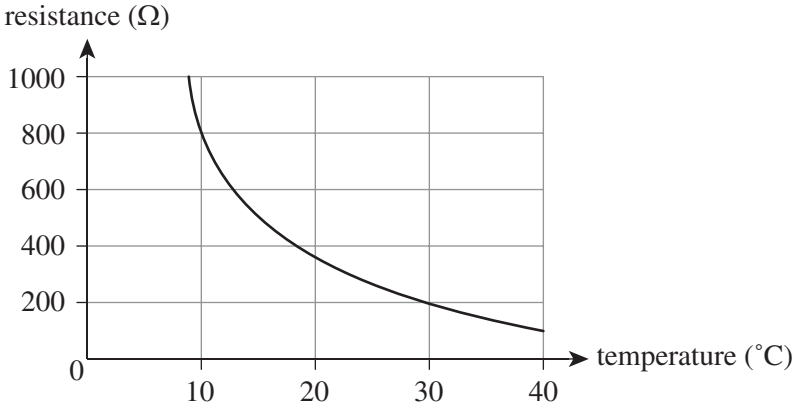
D. a neutron.

Question 9

A refrigerator is required to maintain a temperature below 10°C. The cooling unit of the refrigerator is controlled by a thermistor using the circuit shown below. To turn the cooling unit on, a voltage of 8.0 V is required across the thermistor.



The resistance versus temperature characteristic curve of a thermistor is shown below.



What is the value of the variable resistor shown above when the voltage across the thermistor is 8.0 V?

A. 100 Ω

B. 400 Ω

C. 600 Ω

D. 800 Ω

Question 10

The stable isotope boron-10 is bombarded with neutrons and transforms into lithium-7 by emitting an alpha particle, as shown below.

$$^{10}_{5}\mathrm{B} + {}^{1}_{0}n \rightarrow {}^{7}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He}$$

This is an example of

A. fission.

B. fusion.

C. artificial transmutation.

D. natural transmutation.

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.
Where an answer box is provided, write your final answer in the box.
If an answer box has a unit printed in it, give your answer in that unit.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
Take the value of g to be 9.8 m s^{-2}.

Question 1 (5 marks)
A piece of copper of unknown mass absorbs 2000 J of energy and undergoes a temperature change from 375 K to 475 K.

$$C_{copper} = 385 \text{ J kg}^{-1} \text{ °C}^{-1}$$

a. What is the mass of the piece of copper, correct to three significant figures? Show your working. 3 marks

kg

b. Is this process endothermic or exothermic? Give your reasoning. 2 marks

Question 2 (8 marks)

Figure 1 shows the cooling curve for a 50 g sample of an unknown substance.

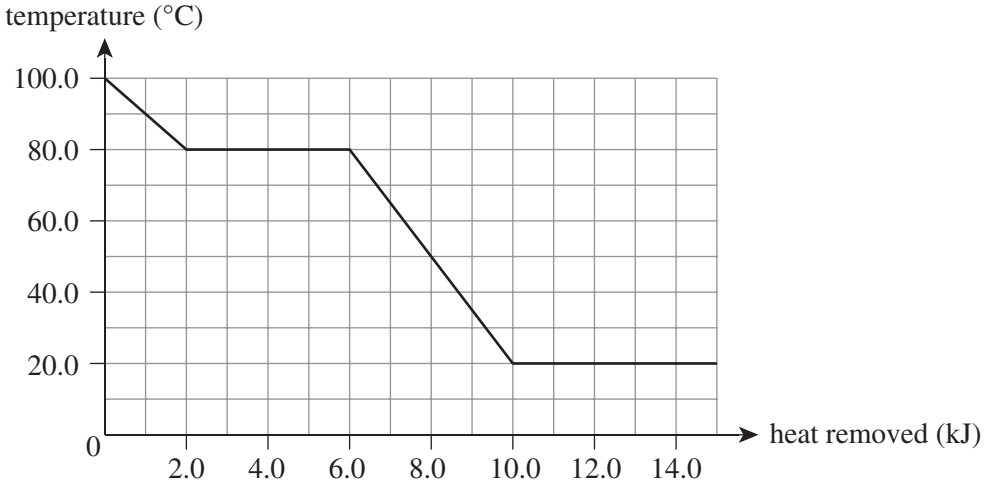


Figure 1

a. What is the freezing point for the sample, in Kelvin? 2 marks

K

b. What happens to the sample when it reaches 80°C? 2 marks

c. Calculate the latent heat of vaporisation, L_v, for the sample. 2 marks

J kg^{-1}

d. Calculate the specific heat capacity of the sample while it is a liquid. 2 marks

$J\ kg^{-1}\ °C$

Question 3 (4 marks)

The Sun is a yellow star with a peak intensity at about 635 nm.

What is the temperature of the surface of the Sun?

°C

Question 4 (2 marks)
Circle the correct response to complete the sentences.

a. As an object gets hotter, the intensity at all wavelengths 1 mark

increases decreases stays the same

b. As an object gets hotter, the peak intensity moves to 1 mark

shorter wavelengths longer wavelengths

Question 5 (3 marks)

a. Identify **two** possible impacts of the enhanced greenhouse effect. 2 marks

b. Identify a strategy for reducing the negative impact of the enhanced greenhouse effect. 1 mark

Question 6 (2 marks)
When a metal spoon with a temperature of 250°C is placed into a beaker of water with a temperature of 950°C, the spoon will heat up.

What type of heat transfer is this? Explain your reasoning.

Question 7 (4 marks)
A cup of water and a swimming pool of water are both at the same temperature.

a. **i.** Is the average kinetic energy of the cup of water greater than, equal to or less than the average kinetic energy of the swimming pool of water? 1 mark

ii. Is the internal energy of the cup of water greater than, equal to or less than the internal energy of the swimming pool of water? 1 mark

b. Explain your reasoning for the answers given in **part a.** 2 marks

Question 8 (6 marks)
Consider the circuit shown in Figure 2.

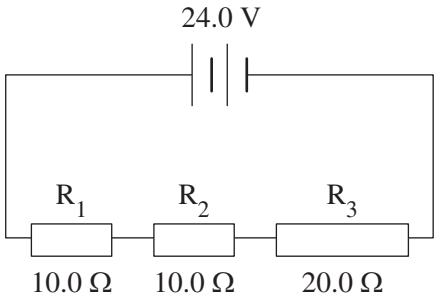


Figure 2

Complete the table of values below for this circuit.

	R_1	**R_2**	**R_3**	**Total**
***V* (V)**				24.0
***I* (A)**				
***R* (Ω)**	10.0	10.0	20.0	
***P* (W)**				

Question 9 (6 marks)
Consider the circuit shown in Figure 3.

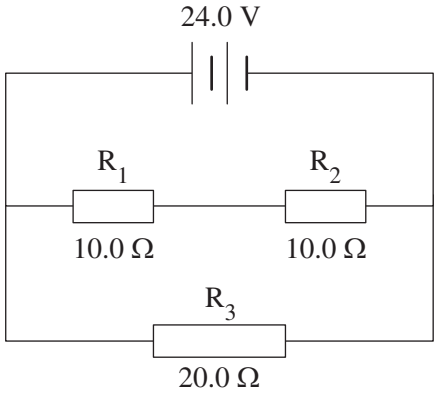


Figure 3

Complete the table of values below for this circuit.

	R_1	**R_2**	**R_3**	**Total**
***V* (V)**				24.0
***I* (A)**				
***R* (Ω)**	10.0	10.0	20.0	
***P* (W)**				

Question 10 (7 marks)

The current versus voltage graph for a diode is shown in Figure 4.

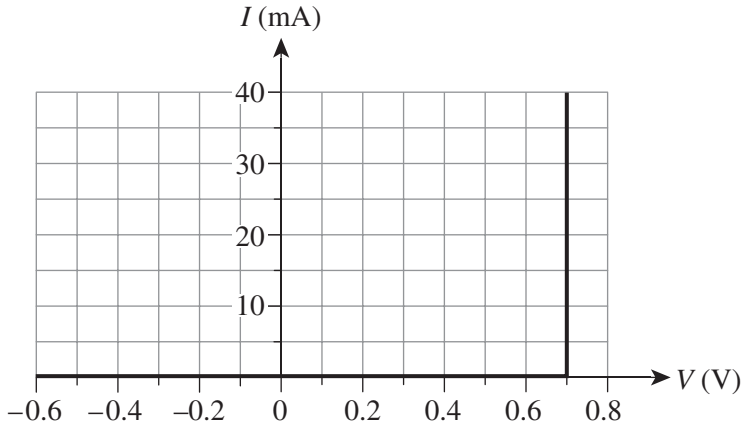


Figure 4

The diode is placed in the circuit shown in Figure 5.

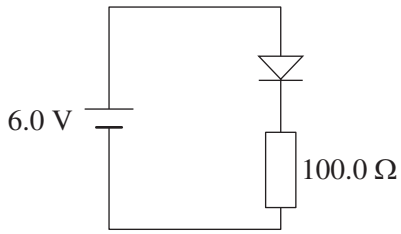


Figure 5

a. What is the potential difference across the diode? 1 mark

V

b. What is the potential difference across the 100 Ω resistor? 1 mark

V

c. What is the current flowing in the circuit? 3 marks

mA

d. The diode is reversed, as shown in Figure 6.

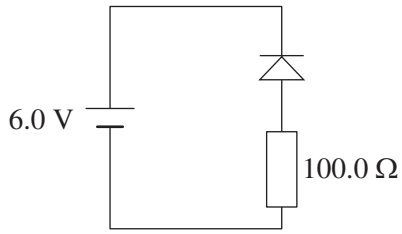


Figure 6

What is the new potential difference across the diode? Explain your reasoning. 2 marks

V

Question 11 (5 marks)

Some appliances are double insulated and do not need an earth pin.

a. What does it mean when an appliance is double insulated? In your answer, identify the role of each layer of insulation. 3 marks

b. Explain why an earth pin is **not** needed for double insulated appliances. 2 marks

Question 12 (7 marks)
Uranium-238 decays into thorium-234 and an alpha particle, as shown in Figure 7.

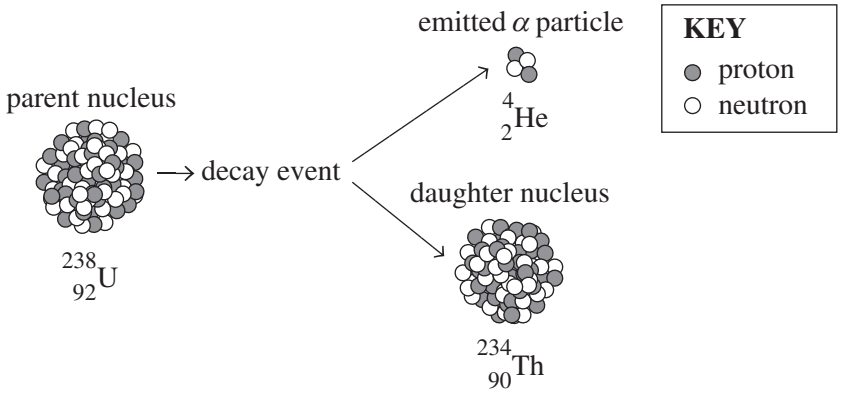


Figure 7

Consider the following data.

Data

$^{238}_{92}\text{U} = 238.0508$ u
$^{234}_{90}\text{Th} = 234.0426$ u
$^{4}_{2}\alpha = 4.0026$ u
$\text{u} = 1.6605 \times 10^{-27}$ kg

a. Write down the full decay equation for uranium-238. 2 marks

b. Calculate the energy released by the decay equation in **part a.** 5 marks

eV

Question 13 (5 marks)
For every matter particle, there is an antimatter particle.

a. Name **one** characteristic that is the same for both a matter particle and its corresponding antimatter particle. 1 mark

b. Explain the main difference between a matter particle and its corresponding antimatter particle. 2 marks

c. Describe what happens when a matter particle and its corresponding antimatter particle collide. 2 marks

Question 14 (4 marks)
Figure 8 shows the end of the decay series for uranium-238.

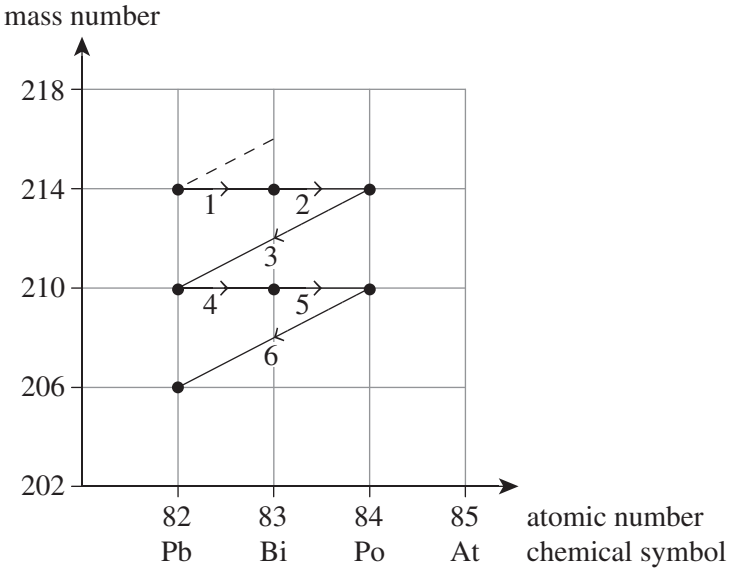


Figure 8

a. Write a decay equation that represents lead-214 decaying to bismuth-214. 2 marks

b. Write a decay equation that represents polonium-206 decaying to lead-206. 2 marks

Question 15 (3 marks)
The Andromeda Galaxy's light is blue-shifted.

a. Explain what is meant by the term 'blue-shifted'. 2 marks

b. What is blueshift evidence of? 1 mark

Question 16 (9 marks)

Figure 9 shows the decay curve for iodine-131, which is a radioactive iodine salt that alters the mechanism of iodine absorption in the thyroid gland. Radioactive isotopes with relatively short half-lives, such as iodine-131, are often used for medical diagnosis and treatment. It is particularly useful for the destruction of overactive cells in the thyroid gland.

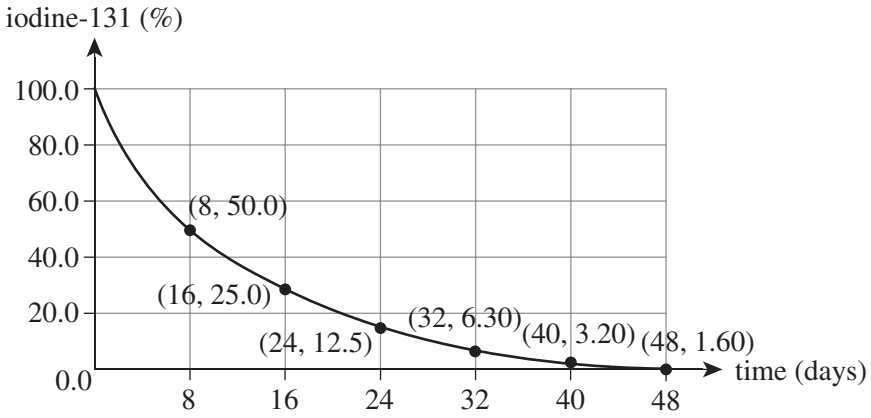


Figure 9

a. Using Figure 9, estimate the half-life of iodine-131. 1 mark

days

b. A patient is administered a dose of this isotope of iodine-131.

What percentage of iodine-131 will remain in the patient's system after 32 days? Show your working. 2 marks

%

c. Explain why radioactive isotopes with relatively short half-lives are desirable for medical diagnostic and treatment purposes. 2 marks

d. Iodine-131 is a beta-minus emitter.

How does beta-minus radiation compare with alpha radiation in terms of mass, charge, penetrating ability and ionising ability? 4 marks

Mass _____

_____

Charge _____

_____

Penetrating ability _____

_____

Ionising ability _____

_____

END OF QUESTION AND ANSWER BOOKLET

Neap

Trial Examination 2021

VCE Physics Unit 1

Written Examination

Formula Sheet

Instructions

This formula sheet is provided for your reference.
A question and answer booklet is provided with this formula sheet.

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

PHYSICS FORMULAS

specific heat	$Q = mc\Delta t$
latent heat	$Q = mL$
Wien's law	$\lambda_{\max} T = 2.9 \times 10^{-3}$ mK
Stefan–Boltzmann law	$P = \sigma T^4$ where Stefan–Boltzmann constant $\sigma = 5.67 \times 10^{-8}$ W m^{-2} K^4
first law of thermodynamics	$\Delta U = Q - W$
mass–energy equation	$E = mc^2$
power	$P = \frac{E}{t}$ or $P = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}$ or $P = Fv$
electrical charge	$Q = It$
electrical work	$W = QV$
voltage	$V = IR$
power	$P = VI$
resistors in series	$R_T = R_1 + R_2 \ldots$
resistors in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} \ldots$
efficiency	$\text{efficiency (\%)} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$

Data

speed of light in a vacuum	$c = 3.0 \times 10^8$ m s^{-1}
1 eV	1.6×10^{-19} J
charge on the electron	$e = 1.6 \times 10^{-19}$ C

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	t = tonne = 10^3 kg

Periodic table of the elements

Key: atomic number 79; symbol of element Au; relative atomic mass 197.0; name of elecment gold

1 H 1.0 hydrogen																	2 He 4.00 helium
3 Li 6.9 lithium	4 Be 9.0 beryllium											5 B 10.8 boron	6 C 12.0 carbon	7 N 14.0 nitrogen	8 O 16.0 oxygen	9 F 19.0 fluorine	10 Ne 20.2 neon
11 Na 23.0 sodium	12 Mg 24.3 magnesium											13 Al 27.0 aluminium	14 Si 28.1 silicon	15 P 30.1 phosphorus	16 S 32.1 sulfur	17 Cl 35.5 chlorine	18 Ar 39.9 argon
19 K 39.1 potassium	20 Ca 40.1 calcium	21 Sc 45.0 scandium	22 Ti 47.9 titanium	23 V 50.9 vanadium	24 Cr 52.0 chromium	25 Mn 54.9 manganese	26 Fe 55.8 iron	27 Co 58.9 cobalt	28 Ni 58.7 nickel	29 Cu 63.5 copper	30 Zn 65.4 zinc	31 Ga 69.7 gallium	32 Ge 72.6 germanium	33 As 74.9 arsenic	34 Se 79.0 selenium	35 Br 79.9 bromine	36 Kr 83.8 krypton
37 Rb 85.5 rubidium	38 Sr 87.6 strontium	39 Y 88.9 yttrium	40 Zr 91.2 zirconium	41 Nb 92.9 niobium	42 Mo 96.0 molybdenum	43 Tc (98) technetium	44 Ru 101.1 ruthenium	45 Rh 102.9 rhodium	46 Pd 106.4 palladium	47 Ag 107.9 silver	48 Cd 112.4 cadmium	49 In 114.8 indium	50 Sn 118.7 tin	51 Sb 121.8 antimony	52 Te 127.6 tellurium	53 I 126.9 iodine	54 Xe 131.3 xenon
55 Cs 132.9 caesium	56 Ba 137.3 barium	57–71 lanthanoids	72 Hf 178.5 hafnium	73 Ta 180.9 tantalum	74 W 183.8 tungsten	75 Re 186.2 rhenium	76 Os 190.2 osmium	77 Ir 192.2 iridium	78 Pt 195.1 platinum	79 Au 197.0 gold	80 Hg 200.6 mercury	81 Tl 204.4 thallium	82 Pb 207.2 lead	83 Bi 209.0 bismuth	84 Po (210) polonium	85 At (210) astatine	86 Rn (222) radon
87 Fr (223) francium	88 Ra (226) radium	89–103 actinoids	104 Rf (261) rutherfordium	105 Db (262) dubnium	106 Sg (266) seaborgium	107 Bh (264) bohrium	108 Hs (267) hassium	109 Mt (268) meitnerium	110 Ds (271) darmstadtium	111 Rg (272) roentgenium	112 Cn (285) copernicium	113 Nh (280) nihonium	114 Fl (289) flerovium	115 Mc (289) moscovium	116 Lv (292) livermorium	117 Ts (294) tennessine	118 Og (294) oganesson

57 La 138.9 lanthanum	58 Ce 140.1 cerium	59 Pr 140.9 praseodymium	60 Nd 144.2 neodymium	61 Pm (145) promethium	62 Sm 150.4 samarium	63 Eu 152.0 europium	64 Gd 157.3 gadolinium	65 Tb 158.9 terbium	66 Dy 162.5 dysprosium	67 Ho 164.9 homium	68 Er 167.3 erbium	69 Tm 168.9 thulmium	70 Yb 173.1 ytterbium	71 Lu 175.0 lutetium
89 Ac (227) actinium	90 Th 232.0 thorium	91 Pa 231.0 protactinium	92 U 238.0 uranium	93 Np (237) neptunium	94 Pu (244) plutonium	95 Am (243) americium	96 Cm (247) curium	97 Bk (247) berkelium	98 Cf (251) californium	99 Es (252) einsteinium	100 Fm (257) fermium	101 Md (258) mendelevium	102 No (259) nobelium	103 Lr (262) lawrencium

The value in the brackets indicates the mass number of the longest-lived isotope.

END OF FORMULA SHEET

Neap

Trial Examination 2021

VCE Physics Unit 1

Written Examination

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out. Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: **A** B C D

Use pencil only

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

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