VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2023

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER | | | | | | | | | | Letter |

PHYSICS
Written examination

Monday 29 May 2023

Reading time: 10.30 am to 10.45 am (15 minutes)
Writing time: 10.45 am to 1.15 pm (2 hours 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	21	21	110
			Total 130

- 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 book of 38 pages
- Formula sheet
- Answer sheet for multiple-choice questions

Instructions
- Write your student number in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book 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 book.
- 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

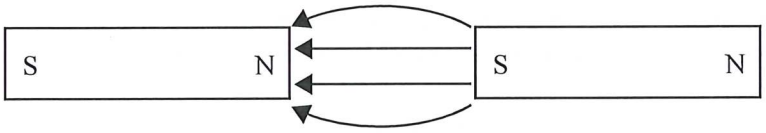
Instructions for Section A

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 book are **not** drawn to scale.
Take the value of g to be 9.8 m s^{-2}.

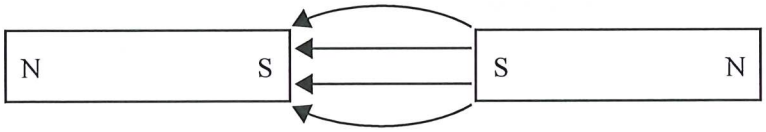
Question 1

Which one of the following diagrams best represents the magnetic field between two magnets?

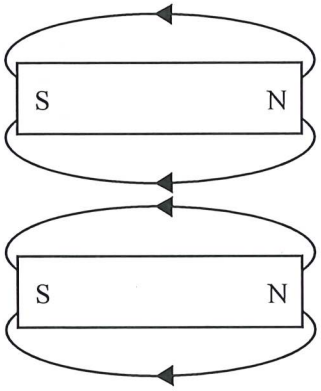
A.



B.

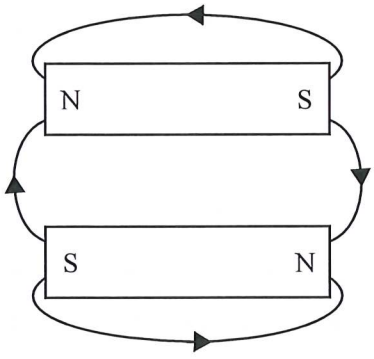


C.



All other options have wrong direction

D.

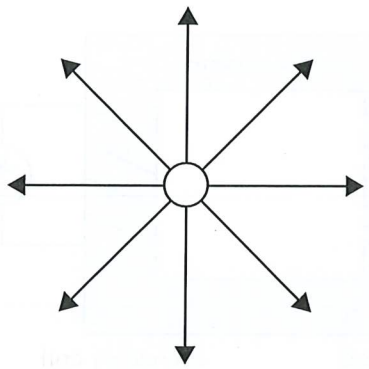


DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 2

Consider the diagram below, which shows a stationary object with field lines that extend outwards from the object.



The field shown is most likely to be identified as an example of

A. an electric field that is uniform.

B. an electric field that is non-uniform.

C. a gravitational field that is uniform.

D. a gravitational field that is non-uniform.

Gravitational field has direction to the object. Spacing between lines increases – non-uniform.

Question 3

Two identical satellites, S_1 and S_2, each of mass m, are placed into two circular orbits around Earth. Satellite S_1 has an orbital radius of $5R$. Satellite S_2 has an orbital radius of R.

Which one of the following best gives the value of $\frac{\text{gravitational force exerted on } S_1 \text{ by Earth}}{\text{gravitational force exerted on } S_2 \text{ by Earth}}$?

A. $\frac{1}{25}$

B. $\frac{1}{10}$

C. 10

D. 25

$F_1 = G\frac{mM}{(5R)^2}$ $F_2 = G\frac{mM}{R^2}$ $\frac{F_1}{F_2} = \frac{1}{25}$

Question 4

Which one of the following statements about the polarisation of waves is correct?

A. Transverse waves can be polarised.

B. Longitudinal waves can be polarised.

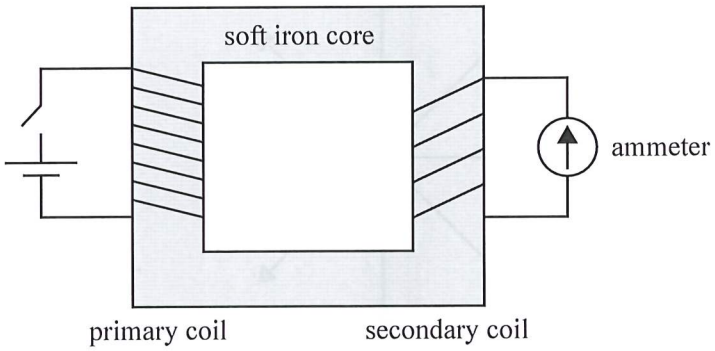
C. Both longitudinal and transverse waves can be polarised.

D. Neither longitudinal nor transverse waves can be polarised.

Polarisation (limiting oscillations to one plane) can be achieved only with transverse waves

Question 5

The diagram below shows an ideal transformer in which the primary coil is connected to a battery and a switch. An ammeter is connected to the secondary coil.



When the switch is closed, the pointer on the ammeter momentarily deflects.

How could the deflection on the ammeter be made larger?

A. decrease the number of primary coils

B. decrease the number of secondary coils

C. increase the number of secondary coils

D. place a resistor in series with the ammeter

Question 6

An RMS current of 15.6 A is equivalent to a peak-to-peak current of

A. 11.0 A

B. 22.1 A

C. 44.1 A

D. 55.2 A

$I_{ptop} = 2\sqrt{2}\, I_{RMS}$

Question 5. Poorly made question.
There are 2 approaches giving different answers.

1) $P_{prim} = P_{second}$

$I_{pr} V_{pr} = I_s V_s$

To have higher current we need lower voltage and to achive that we need decrease number of secondary coils so answer B

2) In a simple circuit like in secondary circuit (by the way ammeter can't be connected like this, it require a load) higher voltage produce higher current so we need to increase voltage in secondary so answer is A or C.

(Must be both)

DO NOT WRITE IN THIS AREA

Question 7

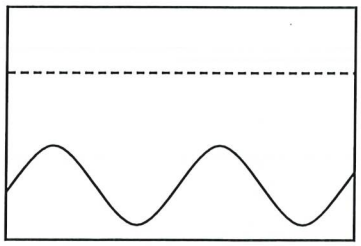
Electrical generators may use slip rings or split-ring commutators when generating electricity. When operating at equal frequencies, the output voltages of these two types of generators can be displayed together on an oscilloscope screen.

The output of the split-ring commutator is displayed as a dotted line.

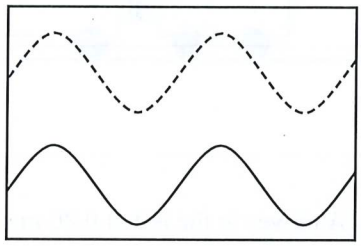
The output of the slip rings is displayed as a solid line.

Which one of the following diagrams best represents the two outputs?

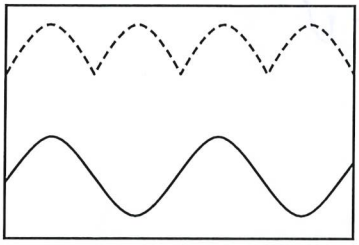
A.



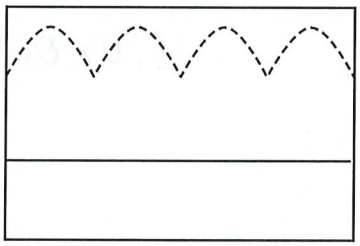
B.



C.



D.



Slip rings provide constant contact with the circuit so output will be AC. Split ring reverse current every half turn.

Question 8

Saturn has 83 moons. One of them, Enceladus, has a mass 1.08×10^{20} kg and a circular orbit of radius 2.38×10^{8} m.

The mass of Saturn is 5.68×10^{26} kg.

Which one of the following is closest to the gravitational force of attraction between Enceladus and Saturn?

A. 0 N

B. 1300 N

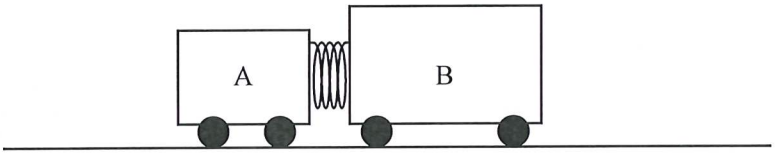
C. 4.9×10^{8} N

D. 7.2×10^{19} N

$F = G\frac{Mm}{r^2} = 6.67 \times 10^{-11} \times \frac{1.08 \times 10^{20} \times 5.68 \times 10^{26}}{(2.38 \times 10^{8})^2}$

Use the following information to answer Questions 9 and 10.

The diagram below shows two stationary trolleys on a smooth surface, with an ideal spring compressed between them. Trolley A has mass of 1.0 kg and Trolley B has mass of 2.5 kg. The spring is released and the trolleys move off in opposite directions. The spring falls straight down.



Question 9

In the first experiment, Trolley A moves to the left at 0.80 m s^{-1}.

Which one of the following is closest to the speed of Trolley B?

A. 0.32 m s^{-1}

B. 0.80 m s^{-1}

C. 2.0 m s^{-1}

D. 3.1 m s^{-1}

$1.0 \times 0.8 = 2.5\ v$

Question 10

The experiment is repeated with a different spring. The spring is compressed 2.8 cm and released. Now Trolley A moves to the left at 1.0 m s^{-1} and Trolley B moves to the right at 0.4 m s^{-1}.

Which one of the following is closest to the spring constant of this spring?

A. 710 N m^{-1}

B. 1100 N m^{-1}

C. 1800 N m^{-1}

D. 6300 N m^{-1}

$$\frac{k \times 0.028^2}{2} = \frac{1 \times 1^2}{2} + \frac{2 \times 0.4^2}{2}$$

Question 11

Which one of the following best describes a hypothesis?

A. an explanation that is correct

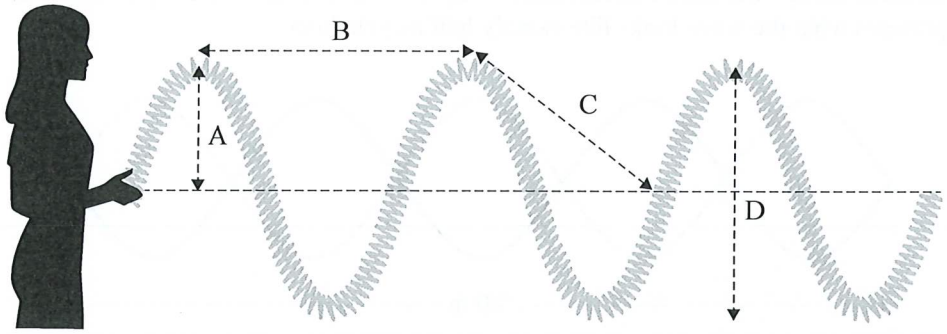
B. a statement that is widely accepted by physicists

C. an explanation that has been supported by experimental evidence

D. a possible explanation that needs to be tested by experimental evidence

Question 12

Sophia is moving the end of a Slinky spring up and down, creating a transverse wave.

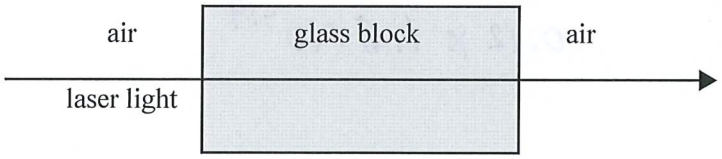


Which of the lines labelled with arrows best represents the amplitude of the wave?

A. line A
B. line B
C. line C
D. line D

Question 13

A ray of monochromatic laser light travels from air, straight through a glass block of refractive index 1.50, as shown below.



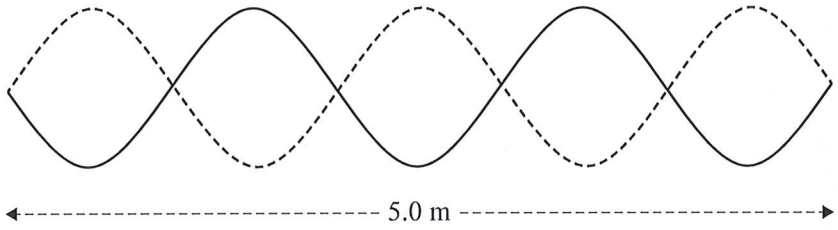
$n_{glass} = 1.50$

Which one of the following best describes what happens to the speed, the wavelength and the frequency of the light ray when it is travelling through the glass block, compared to when it is travelling through air?

	Speed	Wavelength	Frequency
A.	decreases	same	same
B.	decreases	decreases	same
C.	decreases	same	decreases
D.	increases	same	same

Question 14

A standing wave is produced on a flexible string, as shown in the diagram below. The diagram shows the wave at two different times – the solid line represents what the wave looks like at a particular time and the dotted line represents what the wave looks like exactly half a cycle later.



Which one of the following is closest to the wavelength of the standing wave?

A. 0.5 m

B. 1.0 m

C. 1.5 m

D. 2.0 m

$2.5\lambda = 5\ m$

Question 15

Violet light shines on a metal surface and electrons are emitted. The maximum kinetic energy of electrons emitted is measured to be 0.120 eV.

This energy, when expressed in joules, is closest to

A. 1.33×10^{-20} J

B. 1.92×10^{-20} J

C. 1.33×10^{-18} J

D. 1.92×10^{-18} J

$0.12 \times 1.6 \times 10^{-19}$

Question 16

A proton of mass 1.67×10^{-27} kg is accelerated until its de Broglie wavelength is 5.00×10^{-9} m. The speed of the proton is then closest to

A. 1.33×10^{-18} m s^{-1}

B. 1.26×10^{-2} m s^{-1}

C. 79.4 m s^{-1}

D. 5.04×10^{4} m s^{-1}

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

$v = \frac{h}{m\lambda} = \frac{6.63 \times 10^{-34}}{1.67 \times 10^{-27} \times 5 \times 10^{-9}}$

Question 17

Which one of the following light sources produces a full continuous spectrum of visible light?

A. He–Ne laser

B. infra-red heat lamp

C. incandescent globe

D. mercury vapour lamp

Single wavelength

Spectrum without visible light

only several specific wavelengths

Question 18

Light of wavelength 300 nm is just able to cause the photoelectric emission of electrons from a lead surface.

If light of twice this wavelength were incident on a lead surface

$\lambda \times 2$ $E_{ph} \div 2$ so < Work function

A. no photoelectric emission would occur.

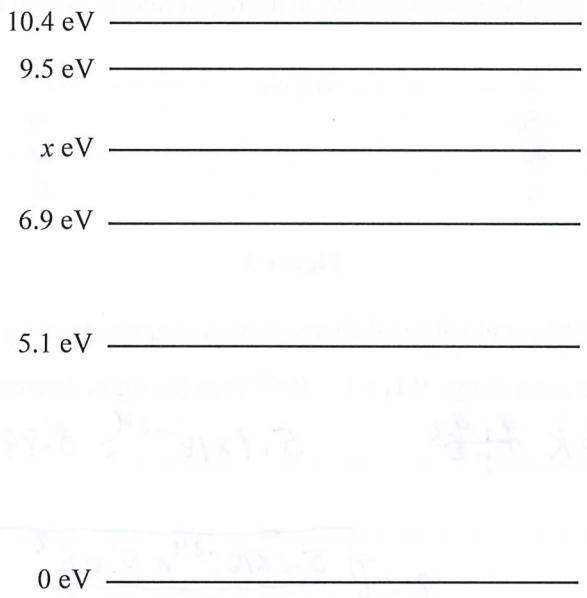
B. half as many electrons would be ejected per second.

C. the same number of electrons would be ejected per second, with twice the energy.

D. the same number of electrons would be ejected per second, with more energy but not necessarily twice as much energy.

Question 19

Some of the energy levels for an unknown atom are shown in the diagram below, with one of the lines labelled x eV. These energy levels are not drawn to scale.



A part of the emission spectrum of the atom shows lines at 1.0 eV, 1.6 eV and 1.9 eV.

The value of x is closest to

$9.5 - 8.5 = 1.0$

$8.5 - 6.9 = 1.6$

$10.4 - 8.5 = 1.9$

A. 7.7

B. 7.9

C. 8.0

D. 8.5

Question 20

A pion and its antiparticle, each at rest, annihilate and produce only two photons with a total energy of 4.5×10^{-11} J. The masses of the pion and its antiparticle are the same.

The rest mass of the pion is closest to

$2mc^2 = 4.5 \times 10^{-11}$

$m = \frac{4.5 \times 10^{-11}}{2 \times 9 \times 10^{16}}$

A. 1.3×10^{-28} kg

B. 2.5×10^{-28} kg

C. 5.0×10^{-28} kg

D. 7.5×10^{-20} kg

END OF SECTION A
TURN OVER