



**Test Papers
Hub.**

VCE Physics Practice Paper 1

Units 3 & 4 — Practice Examination

Section A: 20 multiple-choice (20 marks) · Section B: short-answer and extended-response (100 marks) · 120 marks in all

How to use this booklet

- Reading time – 15 minutes. Writing time – 2 hours 30 minutes. A scientific calculator is permitted. Take $g = 9.8 \text{ m s}^{-2}$ unless stated.
- Section A has 20 multiple-choice questions (1 mark each). Section B has 26 questions (100 marks); show working wherever more than one mark is available.
- A data and formulae sheet is provided at the back of the question paper.
- Worked solutions follow the paper: every question has step-by-step working, a key takeaway and (for multiple choice) a note on why each wrong option is wrong.

SECTION A — MULTIPLE-CHOICE QUESTIONS

20 marks · Answer all 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.

1. A string of length 0.41 m is fixed at both ends. The speed of waves on the string is 340 m s^{-1} . What is the frequency of the fundamental (first harmonic)?

- A 279 Hz
- B 415 Hz
- C 829 Hz
- D 207 Hz

2. An electron moves out of the page through a uniform magnetic field directed towards the north. (The page is horizontal: north is towards the top of the page and east is to the right.) In which direction is the magnetic force on the particle at this instant?

- A north
- B west
- C into the page
- D east

3. Muons are created 15000 m above sea level and travel straight down at $0.935 c$. In the muon's own frame the mean lifetime is $2.2 \times 10^{-6} \text{ s}$. ($c = 3.00 \times 10^8 \text{ m s}^{-1}$.) How far would a muon travel in one lifetime if time dilation did NOT occur?

- A 617 m
- B 1740 m
- C 219 m
- D 660 m

4. A 2.3 kg block slides from rest down a rough slope inclined at 25° to the horizontal. The coefficient of kinetic friction is 0.20. What is the block's acceleration down the slope?

- A 8.05 m s^{-2}
- B 2.37 m s^{-2}
- C 2.18 m s^{-2}
- D 4.14 m s^{-2}

5. In a nuclear reaction the total mass of the products is less than the total mass of the reactants by 2.78×10^{-28} kg. How much energy is released?

- A 2.50×10^{-11} J
- B 3.09×10^{-45} J
- C 8.34×10^{-20} J
- D 1.25×10^{-11} J

6. Two satellites orbit the same planet in circular orbits. Satellite B has an orbital radius 1.5 times that of satellite A. Satellite A has an orbital period of 5.4 h. What is the orbital period of satellite B, in hours?

- A 18.2 h
- B 8.10 h
- C 12.2 h
- D 9.92 h

7. In a double-slit experiment, a dark fringe appears at a point where the path difference from the two slits is:

- A zero
- B a whole number of wavelengths
- C exactly one wavelength only
- D an odd number of half wavelengths

8. Consider the angular momentum of a rotating rigid body ($L = I\omega$). Its angular speed is multiplied by 1.5 and its moment of inertia is tripled, with everything else unchanged. By what factor does the quantity change?

- A $\times \frac{81}{4}$
- B $\times 2.12$
- C $\times \frac{9}{2}$
- D $\times 9$

9. The wave nature of electrons is demonstrated by:

- A the photoelectric effect
- B the emission of electrons from a hot filament
- C electron diffraction patterns from a crystal
- D the deflection of electrons in a magnetic field

WORKED SOLUTIONS

Answers & worked solutions

Multiple-choice answer key

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

SECTION A — MULTIPLE-CHOICE QUESTIONS

1. A string of length 0.41 m is fixed at both ends. The speed of waves on the string is 340 m s^{-1} . What is the frequency of the fundamental (first harmonic)? [Waves]

Correct answer: B — 415 Hz

- For a string fixed at both ends the fundamental has half a wavelength on the string: $\lambda = 2L = 0.820 \text{ m}$.
- $f_1 = v \div \lambda = 340 \div 0.820 = 415 \text{ Hz}$
- Why the other options are wrong:
- A (279 Hz): multiplied instead of dividing
- C (829 Hz): used $\lambda = L$
- D (207 Hz): used $\lambda = 4L$ (a closed pipe)

LOS: Waves

KEY TAKEAWAY

Standing waves on a string fixed at both ends: $L = n\lambda/2$, so $f_n = nv/(2L)$ — all harmonics are present.

2. An electron moves out of the page through a uniform magnetic field directed towards the north. (The page is horizontal: north is towards the top of the page and east is to the right.) In which direction is the magnetic force on the particle at this instant? [Magnetic fields and forces]

Correct answer: D — east

- The force on a moving charge is $F = qv \times B$, perpendicular to both v and B .
- Use the right-hand rule as if the charge were positive (fingers along v , curl towards B , thumb gives the direction), then REVERSE the result because the charge is negative.
- The force is directed east.
- Why the other options are wrong:
- A (north): the magnetic force must be perpendicular to BOTH the velocity and the field, and this direction is not
- B (west): this is the direction for a charge of the opposite sign (the right-hand rule applied the wrong way round)