EXAM PAPER

Physics Unit 3 & 4 — Practice Exam 3

PREVIEW
This file has the first 18 of the 35 questions in this paper. The rest is locked: it comes with a PrepNest plan, or with the paper itself for VCE.

Reading time: 15 minutes (no writing)
Writing time: 150 minutes
Total time: 165 minutes

SECTIONS IN THIS PAPER

- Section A — multiple choice — 25 min (calculator allowed) — 18 questions, 18 marks
- Section B — short answer — 125 min (calculator allowed) — 0 questions, 0 marks

A formula sheet is printed at the end of this paper.

INSTRUCTIONS

You are not permitted to write during reading time — you may only read the paper and plan your approach. Answer every question you can. Write your working in the space provided for long-answer questions. Marking guidance and full explanations are provided in the separate answer key.

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Section A — multiple choice

25 minutes • Calculator allowed

INSTRUCTIONS

- 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.
- Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Question 1

A 1500 kg car accelerates along a level road at 2.0 m s^{-2}. The driving force on the car is 4500 N. The total resistive force acting on the car is

A. 1500 N
B. 3000 N
C. 4500 N
D. 7500 N

Question 2

A ball is thrown at an angle above the horizontal. Ignoring air resistance, which one of the following is true at the highest point of its path?

A. The velocity of the ball is zero.
B. The acceleration of the ball is zero.
C. The net force on the ball is zero.
D. The acceleration of the ball is 9.81 m s^{-2} downwards.

Question 3

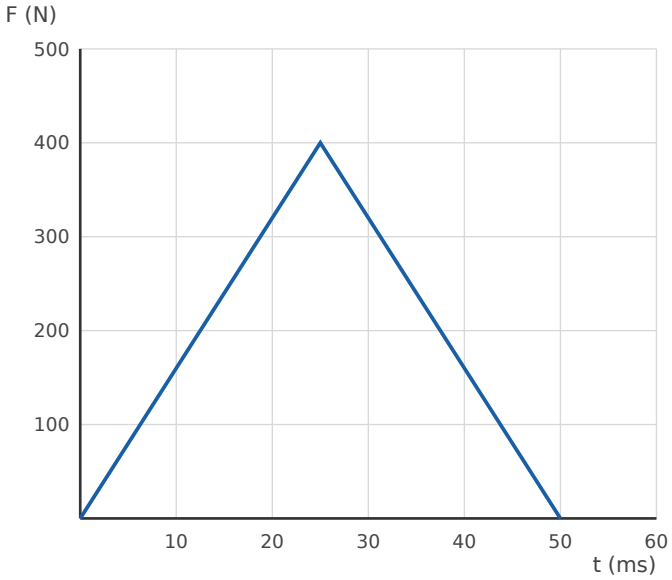
A 70 kg rock climber climbs a vertical height of 12 m in 20 s. The average power used to increase the climber’s gravitational potential energy is closest to

A. 412 W
B. 824 W
C. 8.24 kW
D. 16.5 kW

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Question 4

A 0.20 kg ball at rest is struck by a bat. The graph shows the force on the ball during the impact. The speed of the ball as it leaves the bat is closest to



A. 2.5 m s^{-1}
B. 10 m s^{-1}
C. 50 m s^{-1}
D. 100 m s^{-1}

Question 5

A 1200 kg car travels around a flat, unbanked curve of radius 50 m at a constant speed of 15 m s^{-1}. The magnitude of the sideways friction force on the car's tyres is

A. 4.5 N
B. 360 N
C. 2700 N
D. 5400 N

Question 6

A geostationary satellite stays above the same point on Earth's surface. To do this, the satellite must

A. orbit above the poles
B. orbit above the equator with a period of 24 hours
C. be beyond the reach of Earth's gravity
D. travel faster than a satellite in a low orbit

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Question 7

An alpha particle (charge $+2e$) is accelerated from rest through a potential difference of 1000 V. The kinetic energy it gains is

A. 8.0×10^{-17} J
B. 1.6×10^{-16} J
C. 3.2×10^{-16} J
D. 6.4×10^{-16} J

Question 8

A straight wire 25 cm long carries a current of 3.0 A at right angles to a uniform magnetic field of 0.40 T. The magnitude of the magnetic force on the wire is

A. 0.030 N
B. 0.30 N
C. 3.0 N
D. 30 N

Question 9

The magnetic field inside a long, current-carrying solenoid, well away from its ends, is

A. zero
B. directed radially outwards from the axis
C. uniform and parallel to the axis of the solenoid
D. strongest next to the wires and zero along the axis

Question 10

The magnetic flux through each turn of a 50-turn coil falls uniformly from 0.020 Wb to zero in 0.010 s. The magnitude of the average EMF induced in the coil is

A. 1.0 V
B. 2.0 V
C. 100 V
D. 200 V

Question 11

The coil of a simple AC generator rotates at a constant rate in a uniform magnetic field. The EMF induced in the coil is zero at the instant the plane of the coil is

A. perpendicular to the magnetic field
B. parallel to the magnetic field
C. at 45° to the magnetic field
D. at any angle — the EMF is never zero

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Question 12

An ideal transformer is to step 240 V up to 6000 V. The primary coil has 200 turns. The number of turns needed on the secondary coil is

A. 8
B. 25
C. 5000
D. 12 000

Question 13

A power station transmits a fixed power along the same transmission lines. If the transmission voltage is doubled, the power lost in the lines becomes

A. four times as large
B. twice as large
C. half as large
D. one-quarter as large

Question 14

In a double-slit experiment, adjacent bright bands on a screen are 4.0 mm apart. The slit separation is doubled, with nothing else changed. The new separation of the bright bands is

A. 2.0 mm
B. 4.0 mm
C. 8.0 mm
D. 16 mm

Question 15

Light shining on a metal surface emits photoelectrons. Which one of the following would increase the maximum kinetic energy of the photoelectrons?

A. increasing the intensity of the light
B. increasing the frequency of the light
C. using a metal with a larger work function
D. illuminating a larger area of the metal

Question 16

Electrons are accelerated in an electron diffraction tube and pass through a thin graphite film, producing rings on a screen. The accelerating voltage is then increased. The rings become

A. larger, because the de Broglie wavelength of the electrons increases
B. larger, because the momentum of the electrons increases
C. unchanged, because diffraction depends only on the graphite
D. smaller, because the de Broglie wavelength of the electrons decreases

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Question 17

The three lowest energy levels of hydrogen are −13.6 eV, −3.4 eV and −1.5 eV. Hydrogen atoms in the ground state are exposed to photons of several energies. Which one of these photons can be absorbed?

A. 10.2 eV
B. 11.0 eV
C. 1.9 eV
D. 5.0 eV

Question 18

A clock on a spacecraft travelling at $0.80c$ relative to Earth records a time interval of 1.00 hour. The same interval measured by an observer on Earth is

A. 0.600 hours
B. 1.67 hours
C. 2.00 hours
D. 2.78 hours

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FORMULA SHEET

Physics formulas

Motion and related energy transformations	
velocity; acceleration	$v = \dfrac{\Delta s}{\Delta t}; \quad a = \dfrac{\Delta v}{\Delta t}$
equations for constant acceleration	$v = u + at \qquad s = ut + \frac{1}{2}at^2 \qquad s = vt - \frac{1}{2}at^2$
	$v^2 = u^2 + 2as \qquad s = \frac{1}{2}(u + v)t$
Newton’s second law	$\Sigma F = ma$
uniform circular motion	$F_{\text{net}} = \dfrac{mv^2}{r}; \quad v = \dfrac{2\pi r}{T}$
Hooke’s law	$F = -kx$
elastic potential energy	$E_s = \frac{1}{2}kx^2$
gravitational potential energy	$E_g = mg\Delta h$
kinetic energy	$E_k = \frac{1}{2}mv^2$
Newton’s law of universal gravitation	$F_g = G\dfrac{m_1 m_2}{r^2}$
gravitational field	$g = G\dfrac{M}{r^2}$
impulse	$F\Delta t = m\Delta v$
momentum	$p = mv$

Einstein’s special theory of relativity	
Lorentz factor	$\gamma = \dfrac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$
time dilation	$t = t_0\gamma$
length contraction	$L = \dfrac{L_0}{\gamma}$
relativistic rest energy	$E_0 = mc^2$
relativistic total energy	$E_{\text{total}} = E_k + E_0 = \gamma mc^2$
relativistic kinetic energy	$E_k = (\gamma - 1)mc^2$

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Fields and application of field concepts	
electric field between charged plates	$E = \dfrac{V}{d}$
energy transformations of charges in an electric field	$\frac{1}{2}mv^2 = qV$
field of a point charge	$E = \dfrac{kQ}{r^2}$
electric force on a charged particle	$F = qE$
Coulomb’s law	$F = \dfrac{kq_1q_2}{r^2}$
magnetic force on a moving charge	$F = qvB$
magnetic force on a current-carrying conductor	$F = nIlB$
radius of a charged particle in a uniform magnetic field	$r = \dfrac{mv}{qB}$

Generation and transmission of electricity	
current; power	$I = \dfrac{V}{R}; \quad P = VI$
resistors in series	$R_T = R_1 + R_2 + \cdots$
resistors in parallel	$\dfrac{1}{R_T} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \cdots$
ideal transformer action	$\dfrac{V_1}{V_2} = \dfrac{N_1}{N_2} = \dfrac{I_2}{I_1}$
AC voltage and current	$V_{\text{RMS}} = \dfrac{1}{\sqrt{2}}V_{\text{peak}} \qquad I_{\text{RMS}} = \dfrac{1}{\sqrt{2}}I_{\text{peak}}$
electromagnetic induction	$\varepsilon = -N\dfrac{\Delta\Phi_B}{\Delta t} \qquad \Phi_B = B_{\perp}A$
transmission losses	$V_{\text{drop}} = I_{\text{line}}R_{\text{line}} \qquad P_{\text{loss}} = I_{\text{line}}^2R_{\text{line}}$

Waves	
wave equation	$v = f\lambda$
constructive interference	path difference $= n\lambda$
destructive interference	path difference $= \left(n + \frac{1}{2}\right)\lambda$
interference pattern spacing	$\Delta x = \dfrac{\lambda L}{d}$ when $L \gg d$

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The nature of light and matter	
photoelectric effect	$E_{k\max} = hf - \phi$
photon energy	$E = hf = \dfrac{hc}{\lambda}$
photon momentum	$p = \dfrac{h}{\lambda}$
de Broglie wavelength	$\lambda = \dfrac{h}{p}$

Data		
acceleration due to gravity at Earth's surface	$g = 9.81\ \text{m s}^{-2}$	
mass of the electron	$m_e = 9.11 \times 10^{-31}\ \text{kg}$	
magnitude of the charge of the electron	$q_e = 1.60 \times 10^{-19}\ \text{C}$	
Planck's constant	$h = 6.63 \times 10^{-34}\ \text{J s}$	$h = 4.14 \times 10^{-15}\ \text{eV s}$
speed of light in a vacuum	$c = 3.00 \times 10^{8}\ \text{m s}^{-1}$	
universal gravitation constant	$G = 6.67 \times 10^{-11}\ \text{N m}^2\,\text{kg}^{-2}$	
mass of Earth	$M_E = 5.97 \times 10^{24}\ \text{kg}$	
radius of Earth	$R_E = 6.37 \times 10^{6}\ \text{m}$	
Coulomb constant	$k = 8.99 \times 10^{9}\ \text{N m}^2\,\text{C}^{-2}$	

Metric (SI) multipliers			
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 = tera = 10^{12}

Unit conversions	
1 tonne (t) = 10^3 kg	1 kilowatt hour (kW h) = 3.6×10^6 J

Nomenclature	
force due to gravity	F_g
terminology for force	$F_{\text{on A by B}}$
normal force	F_N

END OF FORMULA SHEET

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17 questions locked, up to question 15.

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PREVIEW

That’s the end of the preview

You’ve seen the first 18 of the 35 questions in Physics Unit 3 & 4 — Practice Exam 3. The full paper is worth 120 marks.

STILL TO COME	QUESTIONS	MARKS
Section A — multiple choice	2	2
Section B — short answer	15	100

The full paper comes with

- Every question, printed exactly like the ones in this preview
- The complete answer key, with the working behind every mark
- A topic report after marking, showing what to practice next

Get the full paper at

prepnest.com.au/practice/exams/physics-year_12-3

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