EXAM PAPER

Physics Unit 3 & 4 — Practice Exam 5

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

Two blocks, of mass 2.0 kg and 3.0 kg, are in contact on a smooth horizontal surface. A horizontal force of 20 N pushes the 2.0 kg block, which pushes the 3.0 kg block. The magnitude of the force that the 2.0 kg block exerts on the 3.0 kg block is

A. 4.0 N
B. 8.0 N
C. 12 N
D. 20 N

Question 2

A 2.0 kg object moving at 5.0 m s^{-1} is acted on by a net force of 10 N in its direction of motion while it moves a further 3.0 m. Its final speed is closest to

A. 5.00 m s^{-1}
B. 5.48 m s^{-1}
C. 6.32 m s^{-1}
D. 7.42 m s^{-1}

Question 3

A car travels around a roundabout of radius 12 m at a constant speed of 6.0 m s^{-1}. The time it takes to complete one full circle is closest to

A. 12.6 s
B. 18.8 s
C. 25.1 s
D. 75.4 s

Question 4

A spring hangs vertically. When a 0.20 kg mass is attached, the spring stretches by 5.0 cm. The spring constant is closest to

A. 0.098 N m^{-1}
B. 4.0 N m^{-1}
C. 39 N m^{-1}
D. 392 N m^{-1}

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Question 5

In a collision, a car’s airbag reduces the risk of injury to the driver mainly because it

A. reduces the driver’s change in momentum
B. reduces the impulse on the driver
C. increases the impulse on the driver
D. increases the time over which the driver’s momentum changes, reducing the average force

Question 6

The gravitational force between two masses is F. Both masses are doubled and the distance between them is halved. The new gravitational force is

A. $2F$
B. $4F$
C. $8F$
D. $16F$

Question 7

Two equal positive point charges are fixed a short distance apart. At the point exactly midway between them, the electric field is

A. zero
B. directed towards the left-hand charge
C. twice the field of one charge alone
D. perpendicular to the line joining the charges

Question 8

An electron moves in a circle in a uniform magnetic field. If its speed is doubled, the radius of its path

A. halves
B. doubles
C. becomes four times as large
D. is unchanged

Question 9

A satellite in a circular orbit of radius r around Earth has orbital speed v. A satellite in a circular orbit of radius $4r$ has orbital speed

A. $4v$
B. $2v$
C. $\frac{v}{2}$
D. $\frac{v}{4}$

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Question 10

The coil of an AC generator rotates in a magnetic field. Which one of the following changes would not increase the peak EMF produced?

A. increasing the resistance of the circuit connected to the generator
B. increasing the number of turns on the coil
C. using a stronger magnetic field
D. rotating the coil faster

Question 11

An ideal transformer has 480 turns on its primary coil and 24 turns on its secondary coil. The primary is connected to 240 V AC. The secondary voltage is

A. 6.0 V
B. 12 V
C. 24 V
D. 4800 V

Question 12

A 2.0 kW appliance is supplied at 240 V through a cable with a total resistance of 0.50 Ω. The power lost in the cable is closest to

A. 4.17 W
B. 8.33 W
C. 34.7 W
D. 1.15×10^{5} W

Question 13

The slip rings of an AC generator are replaced by a split-ring commutator. The output of the generator

A. doubles in frequency
B. doubles in peak voltage
C. becomes a steady, constant voltage
D. always has the same polarity, although it still varies in size

Question 14

A laser pointer emits 5.0 mW of light of wavelength 650 nm. The number of photons it emits each second is closest to

A. 1.6×10^{15}
B. 1.6×10^{16}
C. 3.3×10^{16}
D. 1.6×10^{19}

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Question 15

A metal has a work function of 2.3 eV. The longest wavelength of light that can release photoelectrons from it is closest to

A. 270 nm
B. 400 nm
C. 540 nm
D. 1080 nm

Question 16

In the photoelectric effect, the maximum kinetic energy of the emitted photoelectrons depends on

A. the intensity of the light only
B. the frequency of the light and the work function of the metal
C. the intensity and the frequency of the light
D. the voltage across the photocell only

Question 17

A proton (mass 1.67×10^{-27} kg) travels at $0.80c$. Its kinetic energy is closest to

A. 4.8×10^{-11} J
B. 1.0×10^{-10} J
C. 1.5×10^{-10} J
D. 2.5×10^{-10} J

Question 18

Light passes through a narrow gap. The light spreads out (diffracts) most noticeably when

A. the width of the gap is similar to the wavelength of the light
B. the width of the gap is much larger than the wavelength
C. the light is very bright
D. the light is white rather than a single colour

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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.

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 5. 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_12-5

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