EXAM PAPER

Physics Unit 3 & 4 — Practice Exam 2

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 60 kg person stands on bathroom scales in a lift that is accelerating upwards at 1.5 m s^{-2}. The reading on the scales is closest to

A. 90 N
B. 499 N
C. 589 N
D. 679 N

Question 2

A ball rolls off a horizontal table 1.25 m high at 3.0 m s^{-1}. Ignoring air resistance, the speed of the ball just before it hits the floor is closest to

A. 3.0 m s^{-1}
B. 4.95 m s^{-1}
C. 5.79 m s^{-1}
D. 7.95 m s^{-1}

Question 3

A car drives over the top of a hump in the road. The top of the hump is part of a vertical circle of radius 20 m. The maximum speed at which the car stays in contact with the road at the top is closest to

A. 4.47 m s^{-1}
B. 14.0 m s^{-1}
C. 19.8 m s^{-1}
D. 196 m s^{-1}

Question 4

A 4.0 kg rifle, initially at rest, fires a 0.020 kg bullet horizontally at 400 m s^{-1}. The recoil speed of the rifle is

A. 0.020 m s^{-1}
B. 0.50 m s^{-1}
C. 2.0 m s^{-1}
D. 8.0 m s^{-1}

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Question 5

A spring that obeys Hooke’s law stretches by 0.15 m when a force of 30 N is applied to it. The elastic potential energy stored in the spring is

A. 2.25 J
B. 4.50 J
C. 30.0 J
D. 200 J

Question 6

Planet X has twice the mass of Earth and three times the radius of Earth. The gravitational field strength at the surface of planet X is closest to

A. 1.09 N kg^{-1}
B. 2.18 N kg^{-1}
C. 6.54 N kg^{-1}
D. 19.6 N kg^{-1}

Question 7

A graph shows the gravitational force on a spacecraft against its distance from the centre of Earth. The area under the graph between two distances is equal to the

A. average gravitational field strength between the two distances
B. impulse on the spacecraft
C. power needed to move the spacecraft
D. change in gravitational potential energy of the spacecraft

Question 8

Two point charges exert an electric force of magnitude F on each other. One charge is doubled and the distance between the charges is halved. The new force has magnitude

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

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Question 9

A long straight wire carries a current directly out of the page, as shown below. The direction of the magnetic field at point P is



wire (current out of the page)

A. towards the top of the page
B. towards the bottom of the page
C. to the right
D. into the page

Question 10

A flat loop of area 0.050 m² is in a uniform magnetic field of 0.40 T. The plane of the loop is at 30° to the direction of the field. The magnetic flux through the loop is

A. 0.010 Wb
B. 0.017 Wb
C. 0.020 Wb
D. 8.0 Wb

Question 11

The north pole of a bar magnet is pushed towards one end of a coil connected to a meter. Which one of the following describes the magnetic pole induced at that end of the coil and the force it exerts on the magnet?

	Pole at the near end of the coil	Force on the magnet
A.	south	attractive
B.	north	repulsive
C.	north	attractive
D.	south	repulsive

Question 12

An ideal transformer steps 240 V down to 12 V. The current in the secondary coil is 2.0 A. The current in the primary coil is

A. 0.10 A
B. 2.0 A
C. 24 A
D. 40 A

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Question 13

An AC supply has an RMS voltage of 15.0 V. The peak-to-peak voltage of the supply is closest to

A. 10.6 V
B. 21.2 V
C. 30.0 V
D. 42.4 V

Question 14

Light passes through a single narrow slit and a diffraction pattern forms on a screen. Which one of the following changes would increase the spreading of the light?

A. using blue light instead of red light
B. increasing the intensity of the light
C. decreasing the width of the slit
D. increasing the width of the slit

Question 15

Light of wavelength 250 nm falls on a metal with a work function of 2.30 eV. The stopping voltage for the emitted photoelectrons is closest to

A. 2.30 V
B. 2.67 V
C. 4.97 V
D. 7.27 V

Question 16

The momentum of a photon of wavelength 500 nm is closest to

A. 4.42×10^{-36} kg m s^{-1}
B. 1.33×10^{-27} kg m s^{-1}
C. 1.99×10^{-25} kg m s^{-1}
D. 3.98×10^{-19} kg m s^{-1}

Question 17

White light passes through a container of cool hydrogen gas and then through a prism. The spectrum observed is

A. a continuous spectrum with no gaps
B. bright lines on a dark background
C. bright lines at every visible wavelength
D. a continuous spectrum crossed by dark lines at the wavelengths that hydrogen emits

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Question 18

A spacecraft is 100 m long when measured at rest. It passes an observer at $0.60c$. The length of the spacecraft measured by the observer is

A. 60 m

B. 64 m

C. 80 m

D. 125 m

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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 2. 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_12-2

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