Physics Unit 3 & 4 — Practice Exam 3 — Answers & Explanations

Answers to the 18 questions in the free preview.

Section A — multiple choice

1. A. 1500 N

$F_{\text{net}} = ma = 1500 \times 2.0 = 3000$ N, and $F_{\text{net}} = 4500 - F_{\text{resistive}}$, so the resistive force is 1500 N. 3000 N is the net force.

2. D. The acceleration of the ball is 9.81 m s⁻² downwards.

Only gravity acts throughout the flight, so the acceleration is 9.81 m s⁻² downwards everywhere, including at the top. At the top only the vertical velocity is zero; the horizontal velocity remains.

3. A. 412 W

$P = \frac{mg\Delta h}{t} = \frac{70 \times 9.81 \times 12}{20} = 412$ W. 8.24 kW is the energy (8240 J) mistaken for a power; 16.5 kW multiplies by the time instead of dividing.

4. C. 50 m s⁻¹

The impulse is the area under the force–time graph: $\frac{1}{2} \times 400 \times 0.050 = 10$ N s. Then $v = \frac{\Delta p}{m} = \frac{10}{0.20} = 50$ m s⁻¹. 100 m s⁻¹ uses the full rectangle instead of the triangle; 10 is the impulse, not the speed.

5. D. 5400 N

Friction provides the centripetal force: $F = \frac{mv^2}{r} = \frac{1200 \times 15^2}{50} = 5400$ N. 4.5 is the centripetal acceleration in m s⁻², and 360 N uses v instead of v^2.

6. B. orbit above the equator with a period of 24 hours

To stay above one point, the satellite must turn with Earth: a period of 24 hours, in the equatorial plane, moving in the direction Earth rotates. Its large orbital radius means it travels more slowly than satellites in low orbits ($v = \sqrt{\frac{GM}{r}}$), and gravity still provides its centripetal force.

7. C. 3.2 × 10⁻¹⁶ J

$W = qV = 2 \times 1.60 \times 10^{-19} \times 1000 = 3.2 \times 10^{-16}$ J (2000 eV). 1.6×10^{-16} J uses a single electronic charge.

8. B. 0.30 N

$F = IlB = 3.0 \times 0.25 \times 0.40 = 0.30$ N. 30 N uses the length in centimetres.

9. C. uniform and parallel to the axis of the solenoid

Inside a long solenoid the fields of the individual turns combine to give a strong, uniform field parallel to the axis — like the field between the poles of a bar magnet. Its direction is given by the right-hand grip rule.

10. C. 100 V

$\varepsilon = N\frac{\Delta\Phi_B}{\Delta t} = 50 \times \frac{0.020}{0.010} = 100$ V. 2.0 V is the EMF in a single turn.

11. A. perpendicular to the magnetic field

When the plane of the coil is perpendicular to the field, the flux through it is a maximum but momentarily not changing, so the induced EMF is zero. The EMF is greatest when the plane is parallel to the field, where the flux is zero but changing fastest.

12. C. 5000

$\frac{N_2}{N_1} = \frac{V_2}{V_1} = \frac{6000}{240} = 25$, so $N_2 = 25 \times 200 = 5000$. 8 inverts the ratio; 25 is the ratio itself.

13. D. one-quarter as large

For fixed power, $I = \frac{P}{V}$ halves, and $P_{\text{loss}} = I^2R$ falls by a factor of $2^2 = 4$.

14. A. 2.0 mm

$\Delta x = \frac{\lambda L}{d}$, so doubling d halves the spacing, to 2.0 mm.

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15. B. increasing the frequency of the light

$E_{k\max} = hf - \phi$: each photon then carries more energy. Intensity and area change only the number of photons (and so the number of photoelectrons); a larger work function reduces $E_{k\max}$.

16. D. smaller, because the de Broglie wavelength of the electrons decreases

A larger accelerating voltage gives the electrons more momentum, so $\lambda = \frac{h}{p}$ decreases. Shorter waves diffract through smaller angles, so the rings shrink.

17. A. 10.2 eV

A photon is absorbed only if its energy exactly equals the gap between the ground state and a higher level: $-3.4 - (-13.6) = 10.2$ eV (or 12.1 eV). 1.9 eV matches the $n = 2 \to 3$ gap, but these atoms are in the ground state.

18. B. 1.67 hours

$\gamma = \frac{1}{\sqrt{1-0.80^2}} = 1.67$. The spacecraft clock measures the proper time, so the Earth observer measures $t = t_0\gamma = 1.67$ hours. 0.600 hours divides by γ; 2.78 hours multiplies by γ^2.

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PREVIEW

That’s the end of the preview answers

These are the answers to the 18 preview questions. The full answer key covers all 35 questions in Physics Unit 3 & 4 — Practice Exam 3, with the working behind every mark.

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

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