

Cambridge International AS & A Level · Physics (9702) · Mock Paper Set 1

Mock Paper Set 1**Paper 1 · Paper 2 · Paper 4 · Paper 5, with worked solutions and mark schemes**

For the Cambridge International AS & A Level Physics 9702 syllabus (examinations 2025–2027). Papers 1 and 2: AS content (topics 1–11). Paper 4: A Level content (topics 12–25). Paper 5: planning, analysis and evaluation.

What is inside this set

Paper	Format	Time	Marks
Paper 1 · Multiple Choice AS	40 four-option questions, one mark each; Data and formulae page	1 hour 15 minutes	40
Paper 2 · AS Level Structured Questions AS	7 compulsory structured questions; answer in the spaces provided	1 hour 15 minutes	60
Paper 4 · A Level Structured Questions A	12 compulsory structured questions; Data and formulae pages	2 hours	100
Paper 5 · Planning, Analysis and Evaluation A	2 compulsory questions: a plan (15 marks) and a data analysis with uncertainties and a graph (15 marks)	1 hour 15 minutes	30
Solutions	MCQ key with an explanation for every question; worked solutions and mark schemes for Papers 2, 4 and 5; topic map; self-check	–	–

Paper 3 (Advanced Practical Skills) is a hands-on laboratory examination with real apparatus, so it is not included in this book.

How to use this set

1. Sit each paper in one go, timed, with a calculator, ruler and pencil. No notes. Use only the Data and formulae pages printed with the paper ($g = 9.81 \text{ m s}^{-2}$; write units with negative indices, e.g. m s^{-2}).
2. Write your answers on the paper (Paper 1: on the answer grid at the end of the paper).
3. Mark it yourself with the mark scheme: give a mark only where your answer matches a marking point. Each badge such as **CI** is one mark.
4. Read the worked solution for every question you dropped marks on, then use the topic map to go back to the right chapter of the notes.

Mark-scheme labels

BI independent mark

CI compensatory (method) mark: awarded automatically when the final answer is correct

MI method mark that a following A mark depends on

AI answer mark (correct value with its unit)

grey notes: allow / ignore / do not allow; ecf = error carried forward

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PHYSICS**9702 · Mock Set 1***Paper 1 Multiple Choice**1 hour 15 minutes*

Name

Centre no.

Candidate no.

You will need: the answer grid at the end of this paper · soft pencil (type B or HB) · soft clean eraser · calculator

INSTRUCTIONS

- There are forty questions on this paper. Answer all questions.
- For each question there are four possible answers A, B, C and D. Choose the one you consider correct and record your choice in soft pencil on the answer grid.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Data and formulae page follows.

Data

acceleration of free fall	$g = 9.81 \text{ m s}^{-2}$
speed of light in free space	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
unified atomic mass unit	$1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$
rest mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
rest mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Avogadro constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Boltzmann constant	$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$
gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
permittivity of free space	$\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$ $(\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ m F}^{-1})$
Planck constant	$h = 6.63 \times 10^{-34} \text{ J s}$
Stefan-Boltzmann constant	$\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
hydrostatic pressure	$\Delta p = \rho g \Delta h$
upthrust	$F = \rho g V$
Doppler effect for sound waves	$f_o = \frac{f_s v}{v \pm v_s}$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \dots$
resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$

1. The volt can be expressed in SI base units.

Which expression is equivalent to the volt?

- A $\text{kg m s}^{-2} \text{ A}^{-1}$ B $\text{kg m}^2 \text{ s}^{-2} \text{ A}^{-1}$ C $\text{kg m}^2 \text{ s}^{-3} \text{ A}$ D $\text{kg m}^2 \text{ s}^{-3} \text{ A}^{-1}$

2. Which estimate is reasonable?

- A the diameter of a human hair, $5 \times 10^{-2} \text{ m}$
 B the weight of an apple, $1 \times 10^1 \text{ N}$
 C the top speed of an Olympic sprinter, $1 \times 10^2 \text{ m s}^{-1}$
 D the wavelength of green light, $5 \times 10^{-7} \text{ m}$

3. The kinetic energy E of a trolley is found from measurements of its mass m and speed v .

$$m = 0.250 \text{ kg} \pm 0.005 \text{ kg} \quad v = 4.0 \text{ m s}^{-1} \pm 0.2 \text{ m s}^{-1}$$

What is the value of E , with its percentage uncertainty?

- A $2.0 \text{ J} \pm 7\%$ B $2.0 \text{ J} \pm 10\%$ C $2.0 \text{ J} \pm 12\%$ D $2.0 \text{ J} \pm 27\%$

4. An ice-hockey puck slides due east at 6.0 m s^{-1} . It strikes a cushion at the edge of the rink and moves off due north at 6.0 m s^{-1} .

What is the change in the velocity of the puck?

	<i>magnitude of change</i>	<i>direction of change</i>
A	0	-
B	8.5 m s^{-1}	towards the north-east
C	12 m s^{-1}	towards the north-west
D	8.5 m s^{-1}	towards the north-west

5. At high speed, the drag force F on a car is given by $F = kv^2$, where v is the speed of the car and k is a constant.

What are the SI base units of k ?

- A kg B kg m^{-1} C $\text{kg m}^{-1} \text{s}^{-1}$ D kg m s^{-2}

6. A ball is thrown vertically upwards from ground level with a speed of 14.7 m s^{-1} . Air resistance is negligible.

What is the displacement of the ball from its starting point 2.0 s after it is thrown?

- A 9.8 m B 11 m C 29 m D 49 m

7. A marble rolls off the edge of a horizontal bench top with a horizontal velocity of 2.4 m s^{-1} . The bench top is 0.95 m above the floor. Air resistance is negligible.

How far from the foot of the bench does the marble hit the floor?

- A 0.75 m B 1.1 m C 1.5 m D 2.3 m

8. A ball is thrown vertically upwards. Air resistance on the ball is **not** negligible. The ball rises to its highest point and then falls back to its starting point.

Which row compares the upward and downward parts of the motion?

	<i>time taken to rise compared with time taken to fall</i>	<i>size of acceleration while rising</i>
A	greater	less than g
B	less	greater than g
C	equal	equal to g
D	less	less than g

9. A steel ball X of mass 2.0 kg moves at 3.0 m s^{-1} along a straight frictionless track towards a stationary steel ball Y of mass 1.0 kg. The collision is perfectly elastic and both balls move along the same line afterwards.

What is the speed of ball Y after the collision?

- A 1.0 m s^{-1} B 2.0 m s^{-1} C 3.0 m s^{-1} D 4.0 m s^{-1}

10. Water leaves a hose horizontally at a speed of 12 m s^{-1} and hits a vertical wall. The mass of water leaving the hose each second is 0.60 kg . The water does not bounce back from the wall; it runs down the wall.

What is the horizontal force exerted by the water on the wall?

- A 3.6 N B 5.9 N C 7.2 N D 14 N

11. A parachutist is falling vertically at constant speed.

Which force forms a pair with the weight of the parachutist, as described by Newton's third law?

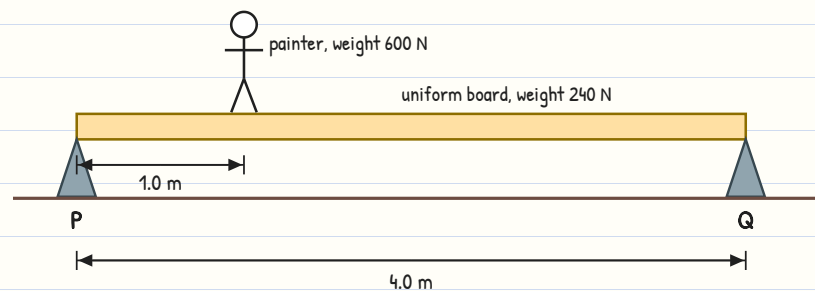
- A the air resistance on the parachutist
B the force of the parachutist on the air
C the gravitational force of the parachutist on the Earth
D the tension in the parachute cords

12. Two blocks rest in contact on a smooth horizontal surface. Block P has mass 3.0 kg and block Q has mass 1.0 kg . A horizontal force of 12 N pushes on P, so that P pushes Q and both blocks accelerate together.

What is the force exerted by P on Q?

- A 3.0 N B 4.0 N C 9.0 N D 12 N

13. A uniform scaffold board of length 4.0 m and weight 240 N rests horizontally on two supports, one at each end. A painter of weight 600 N stands on the board 1.0 m from the support P.



What is the upward force on the board from support P?

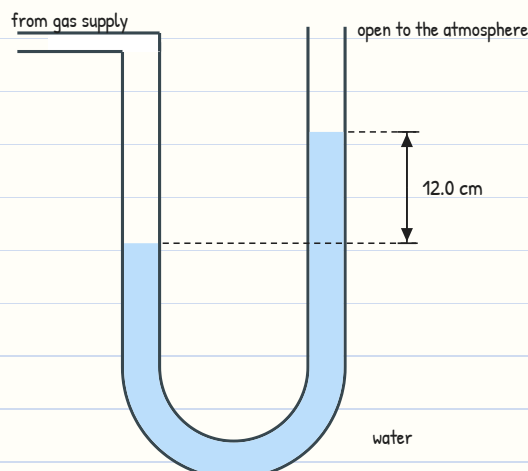
- A 270 N B 420 N C 450 N D 570 N

14. A uniform beam of weight 80 N is hinged to a vertical wall. It is held horizontal by a cable fixed to the far end of the beam. The cable makes an angle of 30° with the beam.



What is the tension in the cable?

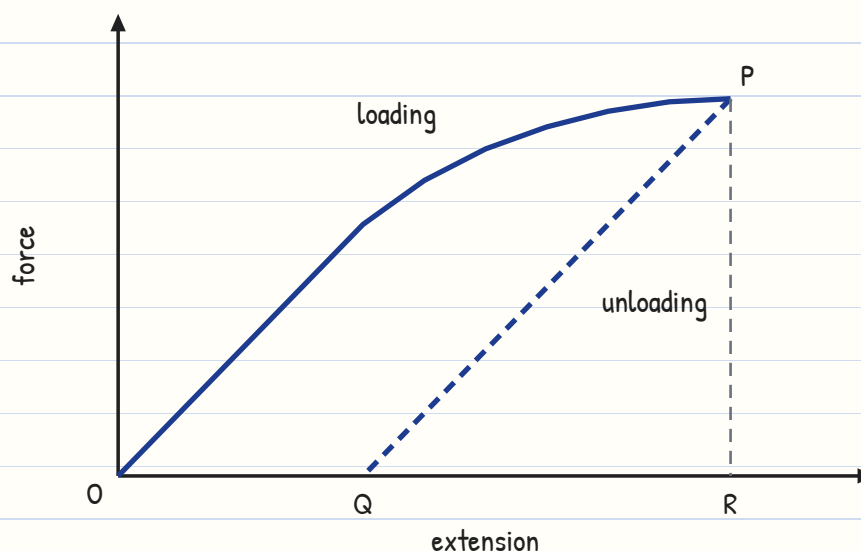
- A 40 N B 46 N C 80 N D 160 N
15. A block of wood of density 650 kg m^{-3} floats in water of density 1000 kg m^{-3} .
What fraction of the volume of the block is above the surface of the water?
- A 0.35 B 0.54 C 0.65 D 1.5
16. A water manometer is connected to a gas supply. The atmospheric pressure is $1.01 \times 10^5 \text{ Pa}$ and the density of water is 1000 kg m^{-3} .



What is the pressure of the gas supply?

- A $1.18 \times 10^3 \text{ Pa}$ B $9.98 \times 10^4 \text{ Pa}$ C $1.02 \times 10^5 \text{ Pa}$ D $1.13 \times 10^5 \text{ Pa}$
17. A crate is dragged 8.0 m in a straight line across a horizontal floor by a rope. The tension in the rope is 50 N and the rope makes an angle of 35° with the horizontal.
How much work is done on the crate by the tension in the rope?
- A 230 J B 330 J C 400 J D 490 J
18. An electric motor raises a lift of total mass 750 kg vertically at a constant speed of 1.6 m s^{-1} . The efficiency of the motor and lifting system is 60%.
What is the input power to the motor?
- A 7.1 kW B 12 kW C 20 kW D 29 kW

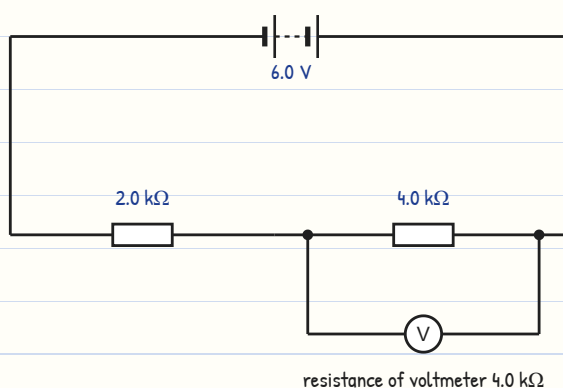
19. A cyclist and her bicycle have a total mass of 80 kg. She freewheels (does not pedal) down a hill and her height decreases by 12 m. Her speed increases from 3.0 m s^{-1} to 13 m s^{-1} .
What is the work done against resistive forces as she travels down the hill?
- A 2.7 kJ B 3.0 kJ C 6.4 kJ D 9.4 kJ
20. Two identical springs, each with spring constant 40 N m^{-1} , are joined end to end. The combination hangs vertically and supports a load of 2.0 N. The springs obey Hooke's law and their masses are negligible.
What is the total extension of the combination?
- A 0.025 m B 0.050 m C 0.10 m D 0.20 m
21. A steel wire of length 2.5 m and diameter 0.60 mm hangs vertically. A load of 90 N is attached to its lower end. The Young modulus of steel is $2.0 \times 10^{11} \text{ Pa}$.
What is the extension of the wire?
- A 0.40 mm B 1.0 mm C 3.1 mm D 4.0 mm
22. A metal wire is loaded beyond its elastic limit and then unloaded. The graph shows the variation with extension of the force on the wire. Loading follows the curve OP; unloading follows the straight line PQ. Point R is on the extension axis directly below P.



- Which area represents the energy that is **not** recovered when the wire is unloaded?
- A the area enclosed by OP, PQ and OQ
 B the area of the triangle QPR
 C the area enclosed by OP, PR and OR
 D the area enclosed by OP, PR and OR, added to the area of the triangle QPR
23. A progressive wave has a wavelength of 0.60 m. Two points on the wave are 0.15 m apart in the direction in which the wave travels.
What is the phase difference between the oscillations of these two points?
- A $\pi/4$ rad B $\pi/2$ rad C π rad D 4π rad

24. The amplitude of a wave decreases from 6.0 mm to 4.0 mm. Its frequency does not change. The intensity of the wave was originally I .
What is the new intensity?
A 0.44 I B 0.67 I C 0.82 I D 1.5 I
25. A motorcycle travels at 30 m s⁻¹ directly towards a stationary observer. The horn of the motorcycle emits sound of frequency 520 Hz. The speed of sound in air is 340 m s⁻¹.
What is the frequency of the sound heard by the observer?
A 474 Hz B 478 Hz C 566 Hz D 570 Hz
26. Orange light from a lamp has a wavelength of 600 nm in a vacuum.
What is the period of the light wave?
A 2.0×10^{-18} s B 2.0×10^{-16} s C 3.2×10^{-16} s D 2.0×10^{-15} s
27. A beam of plane-polarised light of intensity I_0 is incident normally on a single polarising filter. The transmission axis of the filter is at 60° to the plane of polarisation of the light.
What is the intensity of the light transmitted by the filter?
A 0.25 I_0 B 0.50 I_0 C 0.75 I_0 D 0.87 I_0
28. A string is stretched between two fixed points 1.2 m apart. It vibrates at a frequency of 150 Hz, forming a stationary wave with three antinodes.
What is the speed of the progressive waves on the string?
A 60 m s⁻¹ B 120 m s⁻¹ C 180 m s⁻¹ D 360 m s⁻¹
29. Which statement about a stationary wave on a stretched string is correct?
A All the particles between two adjacent nodes oscillate in phase.
B The wave transfers energy along the string.
C The distance between two adjacent antinodes is one wavelength.
D The particles at the nodes oscillate with the greatest amplitude.
30. Two loudspeakers are connected to the same signal generator, so that they emit sound in phase with each other. The wavelength of the sound is 0.40 m. A point X is 3.2 m from one loudspeaker and 3.8 m from the other.
Which statement describes the sound at X?
A It is a minimum, because the path difference is an odd number of half-wavelengths.
B It is a maximum, because the path difference is 1.5 wavelengths.
C It is a maximum, because the two waves have travelled almost the same distance.
D It is a minimum, because the path difference is greater than one wavelength.
31. Violet light of wavelength 400 nm and light of an unknown wavelength λ are incident normally on the same diffraction grating. The third-order maximum of the violet light is at the same angle as the second-order maximum of the other light.
What is the value of λ ?
A 267 nm B 533 nm C 600 nm D 800 nm

32. The potential difference across a car headlamp is 6.0 V. In a time of 8.0 s, 2.0×10^{19} electrons pass through the filament of the lamp.
How much energy is transferred by the electrons in the lamp in this time?
A 19 J B 150 J C 1.2×10^{10} J D 7.5×10^{18} J
33. A wire made of an alloy of resistivity $4.9 \times 10^{-7} \Omega \text{ m}$ has a length of 1.5 m and a resistance of 2.6Ω .
What is the diameter of the wire?
A 0.30 mm B 0.53 mm C 0.60 mm D 1.2 mm
34. A resistor of constant resistance dissipates 2.0 W when the potential difference (p.d.) across it is 4.0 V.
The p.d. is increased to 6.0 V.
What is the new power dissipated?
A 3.0 W B 4.5 W C 6.8 W D 72 W
35. A cell of electromotive force (e.m.f.) 1.50 V and internal resistance 0.50Ω is connected to a resistor of resistance 2.5Ω .
What is the potential difference across the terminals of the cell?
A 0.25 V B 1.20 V C 1.25 V D 1.50 V
36. A battery of e.m.f. 6.0 V and negligible internal resistance is connected to two resistors in series. A voltmeter of resistance $4.0 \text{ k}\Omega$ is connected across the $4.0 \text{ k}\Omega$ resistor.



- What is the reading on the voltmeter?
A 2.0 V B 3.0 V C 4.0 V D 6.0 V
37. A uniform resistance wire XY is 1.000 m long. A supply of e.m.f. 4.00 V and negligible internal resistance is connected across the ends X and Y. A cell of unknown e.m.f., in series with a sensitive galvanometer, is connected between end X and a sliding contact on the wire, with like poles joined. There is no current in the galvanometer when the sliding contact is 37.5 cm from X.
What is the e.m.f. of the cell?
A 0.150 V B 1.50 V C 2.50 V D 10.7 V
38. Which pair of nuclides are isotopes of each other?
A $^{14}_6\text{C}$ and $^{14}_7\text{N}$ B $^{23}_{11}\text{Na}$ and $^{24}_{12}\text{Mg}$ C $^{238}_{92}\text{U}$ and $^{234}_{90}\text{Th}$ D $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$

39. A baryon is made from three quarks chosen from up (u), down (d) and strange (s) quarks. The strange quark has a charge of $-\frac{1}{3}e$.

Which combination of quarks forms a baryon with a charge of $-1e$?

- A uud B uds C udd D dds

40. A nucleus decays by β^- emission.

Which row describes the change in quark composition and the leptons that are emitted?

	<i>quark change</i>	<i>leptons emitted</i>
A	a down quark becomes an up quark	an electron and an electron antineutrino
B	a down quark becomes an up quark	an electron and an electron neutrino
C	an up quark becomes a down quark	a positron and an electron neutrino
D	an up quark becomes a down quark	an electron and an electron antineutrino

END OF PAPER I

Paper I answer grid

Shade or circle one letter for each question. Then mark it with the key in the solutions section.

1 (A) (B) (C) (D)	11 (A) (B) (C) (D)	21 (A) (B) (C) (D)	31 (A) (B) (C) (D)
2 (A) (B) (C) (D)	12 (A) (B) (C) (D)	22 (A) (B) (C) (D)	32 (A) (B) (C) (D)
3 (A) (B) (C) (D)	13 (A) (B) (C) (D)	23 (A) (B) (C) (D)	33 (A) (B) (C) (D)
4 (A) (B) (C) (D)	14 (A) (B) (C) (D)	24 (A) (B) (C) (D)	34 (A) (B) (C) (D)
5 (A) (B) (C) (D)	15 (A) (B) (C) (D)	25 (A) (B) (C) (D)	35 (A) (B) (C) (D)
6 (A) (B) (C) (D)	16 (A) (B) (C) (D)	26 (A) (B) (C) (D)	36 (A) (B) (C) (D)
7 (A) (B) (C) (D)	17 (A) (B) (C) (D)	27 (A) (B) (C) (D)	37 (A) (B) (C) (D)
8 (A) (B) (C) (D)	18 (A) (B) (C) (D)	28 (A) (B) (C) (D)	38 (A) (B) (C) (D)
9 (A) (B) (C) (D)	19 (A) (B) (C) (D)	29 (A) (B) (C) (D)	39 (A) (B) (C) (D)
10 (A) (B) (C) (D)	20 (A) (B) (C) (D)	30 (A) (B) (C) (D)	40 (A) (B) (C) (D)

Score: / 40

Worked solutions and mark schemes

Mark your papers first, then read the explanations. Totals: Paper 1 = 40, Paper 2 = 60, Paper 4 = 100, Paper 5 = 30.

Paper 1 Multiple Choice: answer key

1 D	2 D	3 C	4 D	5 B	6 A	7 B	8 B	9 D	10 C
11 C	12 A	13 D	14 C	15 A	16 C	17 B	18 C	19 B	20 C
21 D	22 A	23 B	24 A	25 D	26 D	27 A	28 B	29 A	30 A
31 C	32 A	33 C	34 B	35 C	36 B	37 B	38 D	39 D	40 A

Key balance: A 10 · B 10 · C 10 · D 10. One mark for each correct answer.

Paper 1: worked solutions

1 **D**

$V = W/Q$ (joules per coulomb). $1 \text{ J} = 1 \text{ N m} = 1 \text{ kg m}^2 \text{ s}^{-2}$ and $1 \text{ C} = 1 \text{ A s}$, so $1 \text{ V} = \text{kg m}^2 \text{ s}^{-2} \div (\text{A s}) = \text{kg m}^2 \text{ s}^{-2} \text{ A}^{-1}$. B forgets that the coulomb contains a second; C puts the ampere on the wrong side; A starts from the newton instead of the joule.

2 **D**

Green light has a wavelength of about $500 \text{ nm} = 5 \times 10^{-7} \text{ m}$. The others are wrong by large factors: a hair is about $5 \times 10^{-5} \text{ m}$ across (A is 5 cm), an apple of mass about 0.1 kg weighs about 1 N (B is ten times too big), and a top sprinter reaches about 10 m s^{-1} (C is ten times too big).

3 **C**

$E = \frac{1}{2}mv^2 = \frac{1}{2} \times 0.250 \times 4.0^2 = 2.0 \text{ J}$. Percentage uncertainties add, and a power multiplies its percentage: m gives $0.005/0.250 = 2\%$, v^2 gives $2 \times (0.2/4.0) = 2 \times 5\% = 10\%$. Total 12% . A forgets to double the 5% for v^2 ; B leaves out the mass; D squares the percentage ($5^2 = 25$) instead of doubling it.

4 **D**

Change in velocity = final velocity – initial velocity = $(6.0 \text{ m s}^{-1} \text{ north}) + (6.0 \text{ m s}^{-1} \text{ west})$. These are at right angles, so the magnitude is $\sqrt{(6.0^2 + 6.0^2)} = 8.5 \text{ m s}^{-1}$, directed towards the north-west. A treats velocity as a scalar (same speed, so "no change"); B adds the two velocities instead of subtracting; C adds the magnitudes.

5 **B**

$k = F/v^2$. Units: $\text{kg m s}^{-2} \div (\text{m s}^{-1})^2 = \text{kg m s}^{-2} \div (\text{m}^2 \text{ s}^{-2}) = \text{kg m}^{-1}$. C would be the unit of k in a drag law $F = kv$ (proportional to speed); D is the unit of force itself.

6 **A**

Take upwards as positive: $s = ut + \frac{1}{2}at^2 = 14.7 \times 2.0 + \frac{1}{2} \times (-9.81) \times 2.0^2 = 29.4 - 19.6 = 9.8 \text{ m}$. The ball reached its highest point (11 m , option B) after 1.5 s and is now on its way down. C ignores gravity; D adds the gravity term instead of subtracting it.

7 **B**

The vertical motion starts from zero vertical velocity: $0.95 = \frac{1}{2} \times 9.81 \times t^2$, so $t = 0.44 \text{ s}$. The horizontal velocity is constant, so the distance = $2.4 \times 0.44 = 1.06 \text{ m} \approx 1.1 \text{ m}$. A leaves out the factor 2 ($t = \sqrt{(h/g)}$); C uses $t = \sqrt{(4h/g)}$; D multiplies the speed by the height.

8 B

On the way up, the weight and the air resistance both act downwards, so the deceleration is greater than g . On the way down the air resistance acts upwards, so the acceleration is less than g . The ball also loses energy, so it moves more slowly on the way down over the same distance: the time to rise is less than the time to fall.

9 D

Momentum: $2.0 \times 3.0 = 2.0v_X + 1.0v_Y$. For a perfectly elastic collision the relative speed of approach equals the relative speed of separation: $v_Y - v_X = 3.0$. Solving: $v_X = 1.0 \text{ m s}^{-1}$ and $v_Y = 4.0 \text{ m s}^{-1}$. B is the common speed if the balls stuck together; C assumes the velocities are simply exchanged, which happens only for equal masses.

10 C

Force = rate of change of momentum = (mass per second) $\times$ (change in velocity) = $0.60 \times (12 - 0) = 7.2 \text{ N}$. D assumes the water bounces back at 12 m s^{-1} (change in velocity 24 m s^{-1}); B is the weight of 0.60 kg of water, which is not a horizontal force.

11 C

The two forces of a Newton's third law pair are of the same type and act on different bodies. The weight is the gravitational pull of the Earth on the parachutist, so its pair is the gravitational pull of the parachutist on the Earth. The air resistance (A) is equal and opposite to the weight only because the speed is constant: that is Newton's first law, and both forces act on the parachutist.

12 A

Both blocks have the same acceleration: $a = 12/(3.0 + 1.0) = 3.0 \text{ m s}^{-2}$. The only horizontal force on Q is the push from P, so $F = 1.0 \times 3.0 = 3.0 \text{ N}$. C (9.0 N) is the resultant force on P ($12 \text{ N} - 3.0 \text{ N}$); D assumes the full 12 N is passed on.

13 D

Take moments about Q. The board's weight acts at its centre, 2.0 m from Q; the painter is 3.0 m from Q. $R_P \times 4.0 = 240 \times 2.0 + 600 \times 3.0 = 2280$, so $R_P = 570 \text{ N}$. A (270 N) is the force at Q; C forgets the weight of the board; B shares the total weight equally.

14 C

Moments about the hinge: the perpendicular component of the tension, $T \sin 30^\circ$, acts at distance L ; the weight acts at $L/2$. $T \sin 30^\circ \times L = 80 \times L/2$, so $T = 40/0.50 = 80 \text{ N}$. A ignores the angle; B uses $\cos 30^\circ$; D forgets that the weight of a uniform beam acts at its centre.

15 A

A floating object: weight = upthrust, so $\rho_{\text{wood}} V g = \rho_{\text{water}} V_{\text{sub}} g$ and $V_{\text{sub}}/V = 650/1000 = 0.65$. The fraction above the surface is $1 - 0.65 = 0.35$. C is the fraction below the surface; D is the ratio of densities the wrong way up.