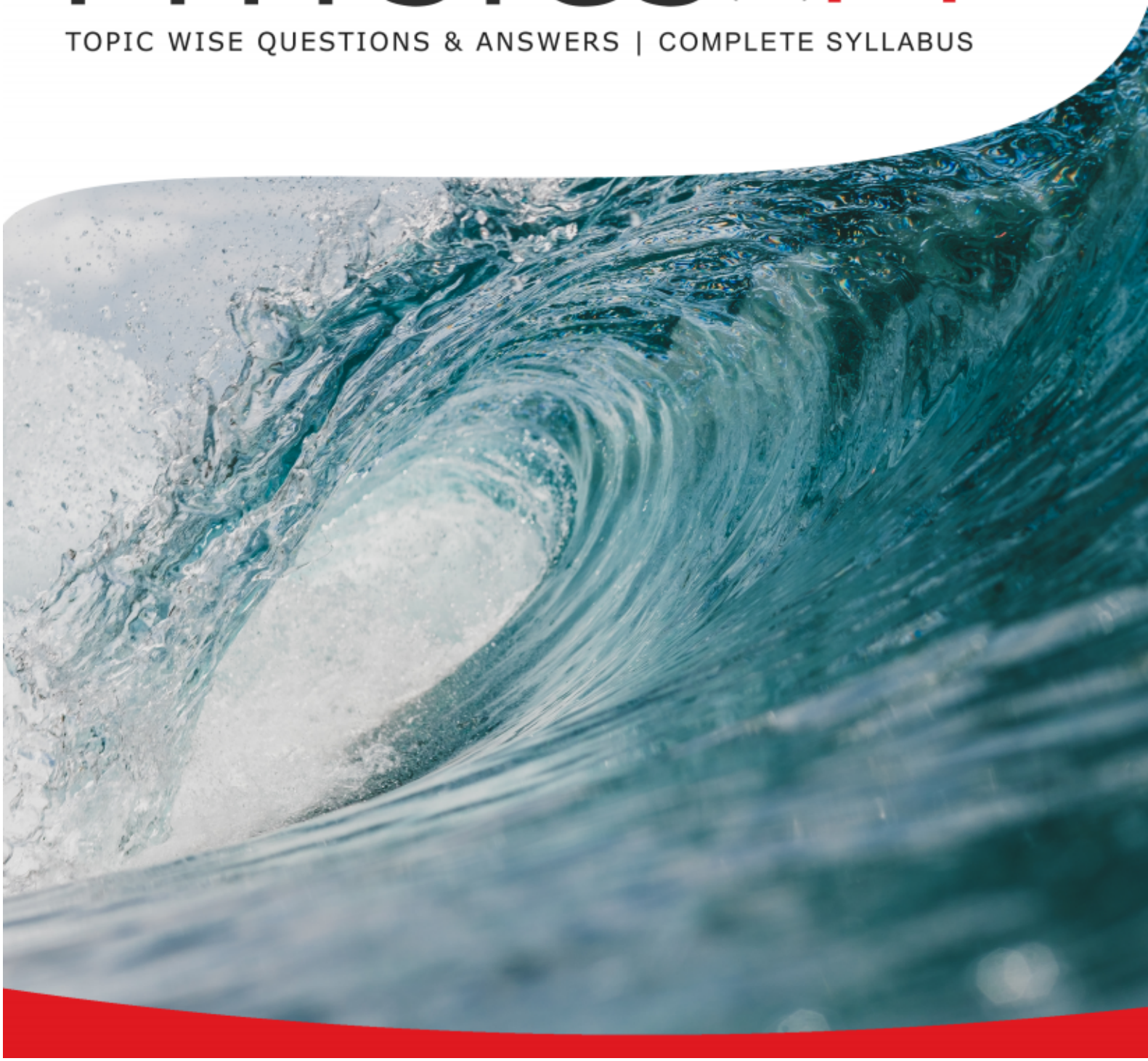
Cambridge International AS & A Level

PHYSICS (9702) P1

TOPIC WISE QUESTIONS & ANSWERS | COMPLETE SYLLABUS



PapaCambridge

Chapter 1

Physical quantities and units

1.1 Physical quantities

1. 9702_m20_qp_12 Q: 1

The table shows some measurable quantities.

Which row gives the correct order of magnitude of the measurable quantity in the stated unit?

	measurable quantity	order of magnitude	unit
A	mass of a coin	10^{-4}	kg
B	thickness of a sheet of paper	10^{-2}	m
C	weight of an apple	10^{0}	N
D	temperature of a person's body	10^{1}	K

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2. 9702_s20_qp_11 Q: 1

What is a reasonable estimate of the kinetic energy of a car travelling at a speed of 30 $m\,s^{-1}$?

A 10^{2} J **B** 10^{4} J **C** 10^{6} J **D** 10^{8} J

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3. 9702_s20_qp_12 Q: 1

What is a reasonable estimate of the mass of a raindrop?

A 10^{1} kg **B** 10^{-1} kg **C** 10^{-3} kg **D** 10^{-5} kg

---

4. 9702_s20_qp_13 Q: 1

A man is running a race in a straight line.

What is an approximate value of his kinetic energy?

A 10 J **B** 100 J **C** 1000 J **D** 10 000 J

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5. 9702_s19_qp_13 Q: 4

What is the approximate kinetic energy of an Olympic athlete when running at maximum speed during a 100 m race?

A 400 J **B** 4000 J **C** 40 000 J **D** 400 000 J

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6. 9702_w19_qp_11 Q: 1

For which quantity is the magnitude a reasonable estimate?

A frequency of a radio wave 500 pHz

B mass of an atom 500 μg

C the Young modulus of a metal 500 kPa

D wavelength of green light 500 nm

---

7. 9702_w19_qp_12 Q: 1

A cyclist has a speed of 5 m s^{-1} and a small car has a speed of 12 m s^{-1}.

Which statement does **not** give a reasonable estimate?

A The kinetic energy of the cyclist is 1×10^3 J.

B The kinetic energy of the car is 7×10^4 J.

C The momentum of the cyclist is 4×10^2 kg m s^{-1}.

D The momentum of the car is 2×10^5 kg m s^{-1}.

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8. 9702_s18_qp_11 Q: 1

What is a unit for stress?

A kg m^{-1} s^{-2} **B** kg m^{-2} s^{-2} **C** N m^{-1} **D** N m

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9. 9702_s18_qp_12 Q: 1

A sheet of gold leaf has a thickness of 0.125 μm. A gold atom has a radius of 174 pm.

Approximately how many layers of atoms are there in the sheet?

A 4 **B** 7 **C** 400 **D** 700

---

10. 9702_s18_qp_13 Q: 1

What is the best way of describing a physical quantity?

A a quantity with a magnitude and a direction but no unit

B a quantity with a magnitude and a unit

C a quantity with a magnitude but no direction

D a quantity with a unit but no magnitude

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11. 9702_w18_qp_11 Q: 1

The radius of the Earth is approximately 6.4×10^6 m, and the radius of the Moon is approximately 1.7×10^6 m. A student wishes to build a scale model of the Solar System in the classroom, using a football of radius 0.12 m to represent the Earth.

Which object would best represent the Moon?

A basketball

B cherry

C golf ball

D tennis ball

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12. 9702_w18_qp_12 Q: 1

A car is travelling at a speed of 20 m s^{-1}. The table contains values for the kinetic energy and the momentum of the car.

Which values are reasonable estimates?

	kinetic energy / J	momentum / kg m s^{-1}
A	3×10^5	3×10^4
B	3×10^5	5×10^6
C	2×10^7	3×10^4
D	2×10^7	5×10^6

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13. 9702_w18_qp_13 Q: 1

Which statement is **not** a reasonable estimate?

A Atmospheric pressure at sea level is about 1×10^5 Pa.

B Light takes 5×10^2 s to reach us from the Sun.

C The frequency of ultraviolet light is 3×10^{12} Hz.

D The lifespan of a man is about 2×10^9 s.

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14. 9702_m17_qp_12 Q: 2

What is an approximate value for the speed of sound in air?

A $30\,m\,s^{-1}$ **B** $300\,m\,s^{-1}$ **C** $30\,000\,m\,s^{-1}$ **D** $300\,000\,000\,m\,s^{-1}$

---

15. 9702_s17_qp_11 Q: 1

A student creates a table to show reasonable estimates of some physical quantities.

Which row is **not** a reasonable estimate?

	quantity	value
A	current in a fan heater	12 A
B	mass of an adult person	70 kg
C	speed of an Olympic sprint runner	$10\,m\,s^{-1}$
D	water pressure at the bottom of a garden pond	10^6 Pa

---

16. 9702_s17_qp_12 Q: 1

What is the approximate average speed of a winning female Olympic athlete running a 100 m race?

A $6\,m\,s^{-1}$ **B** $9\,m\,s^{-1}$ **C** $12\,m\,s^{-1}$ **D** $15\,m\,s^{-1}$

---

17. 9702_s17_qp_13 Q: 1

What is the best estimate of the kinetic energy of a family car travelling at $50\,km\,h^{-1}$?

A 1.5×10^3 J **B** 1.5×10^5 J **C** 1.5×10^7 J **D** 1.5×10^9 J

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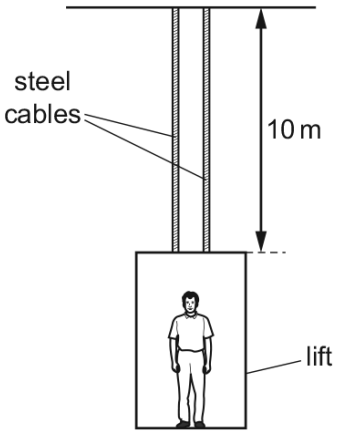
18. 9702_s16_qp_11 Q: 3

A lift is supported by two steel cables, each of length 10 m and diameter 0.5 cm.



NOT TO SCALE

The cables extend by 1 mm when a man of mass 80 kg steps into the lift.

What is the best estimate of the value of the Young modulus of the steel?

A $2 \times 10^{10}\,\text{N m}^{-2}$

B $4 \times 10^{10}\,\text{N m}^{-2}$

C $2 \times 10^{11}\,\text{N m}^{-2}$

D $4 \times 10^{11}\,\text{N m}^{-2}$

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19. 9702_s16_qp_12 Q: 1

Which quantity with its unit is correct?

A acceleration of a bicycle = $1.4\,\text{m s}^{-1}$

B electric current in a lamp = $0.25\,\text{A s}^{-1}$

C electric potential difference across a battery = $8.0\,\text{J C}^{-1}$

D kinetic energy of a car = $4500\,\text{N m}^{-1}$

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20. 9702_w16_qp_11 Q: 1

What is the order of magnitude of the Young modulus for a metal such as copper?

A $10^{-11}\,\text{Pa}$ **B** $10^{-4}\,\text{Pa}$ **C** $10^{4}\,\text{Pa}$ **D** $10^{11}\,\text{Pa}$

---

21. 9702_w16_qp_13 Q: 1

What is the order of magnitude of the Young modulus for a metal such as copper?

A $10^{-11}\,\text{Pa}$ **B** $10^{-4}\,\text{Pa}$ **C** $10^{4}\,\text{Pa}$ **D** $10^{11}\,\text{Pa}$

1.2 SI units

22. 9702_m20_qp_12 Q: 2

A byte (b) comprises 8 bits.

How many bits are there in 1 terabyte (1Tb)?

A 1×10^{9} **B** 8×10^{9} **C** 1×10^{12} **D** 8×10^{12}

---

23. 9702_s20_qp_11 Q: 2

The frequency f of vibration of a mass m supported by a spring with spring constant k is given by the equation

$$f = Cm^{p}k^{q}$$

where C is a constant with no units.

What are the values of p and q?

	p	q
A	$-\frac{1}{2}$	$-\frac{1}{2}$
B	$-\frac{1}{2}$	$\frac{1}{2}$
C	$\frac{1}{2}$	$-\frac{1}{2}$
D	$\frac{1}{2}$	$\frac{1}{2}$

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24. 9702_s20_qp_13 Q: 2

A sample of gas has a mass of 4.8 μg and occupies a volume of 1.2 dm^3.

What is the density of the sample of gas?

A $4.0 \times 10^{-3}\,kg\,m^{-3}$

B $4.0 \times 10^{-5}\,kg\,m^{-3}$

C $4.0 \times 10^{-6}\,kg\,m^{-3}$

D $4.0 \times 10^{-8}\,kg\,m^{-3}$

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25. 9702_m19_qp_12 Q: 2

At temperatures close to 0 K, the specific heat capacity c of a particular solid is given by $c = bT^3$, where T is the temperature and b is a constant, characteristic of the solid.
The SI unit of specific heat capacity is $J\,kg^{-1}\,K^{-1}$.

What is the unit of constant b, expressed in SI base units?

A $m^2\,s^{-2}\,K^{-3}$

B $m^2\,s^{-2}\,K^{-4}$

C $kg\,m^2\,s^{-2}\,K^{-3}$

D $kg\,m^2\,s^{-2}\,K^{-4}$

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26. 9702_s19_qp_11 Q: 1

Which unit can be expressed in base units as $kg\,m^2\,s^{-2}$?

A joule

B newton

C pascal

D watt

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27. 9702_s19_qp_11 Q: 2

The luminosity L of a star is given by

$$L = 4\pi r^2 \sigma T^4$$

where

r is the radius of the star,

T is the temperature of the star and

σ is a constant with units $W\,m^{-2}\,K^{-4}$.

What are the SI base units of L?

A $kg\,m^2\,s^{-1}$ **B** $kg\,m^2\,s^{-2}$ **C** $kg\,m^2\,s^{-3}$ **D** $kg\,m^2\,s^{-4}$

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28. 9702_s19_qp_12 Q: 1

What is equivalent to 2000 microvolts?

A $2\,\mu J\,C^{-1}$ **B** 2 mV **C** 2 pV **D** 2000 mV

---

29. 9702_s19_qp_12 Q: 2

What is the number of SI base units required to express electric field strength and power?

	electric field strength	power
A	3	3
B	3	2
C	4	2
D	4	3

---

30. 9702_s19_qp_12 Q: 3

The Planck constant h has SI units J s.

Which equation could be used to calculate the Planck constant?

A $h = \frac{DE}{v}$ where D is distance, E is energy and v is velocity

B $h = \frac{v}{D}$ where v is velocity and D is distance

C $h = \frac{1}{4\pi E}$ where E is electric field strength

D $h = \frac{Fr^2}{m}$ where F is force, r is radius and m is mass

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31. 9702_s19_qp_13 Q: 1

Which is an SI base unit?

A current

B gram

C kelvin

D volt

---

32. 9702_s19_qp_13 Q: 2

Osmium, a naturally occurring element, has a density of 23 000 kg m^{-3}.

What is also a value of the density of osmium?

A 2.3×10^4 μg cm^{-3}

B 2.3×10^4 g cm^{-3}

C 2.3 kg cm^{-3}

D 2.3×10^{-2} kg cm^{-3}

---

33. 9702_w19_qp_11 Q: 2

The speed of a wave in deep water depends on its wavelength L and the acceleration of free fall g.

What is a possible equation for the speed v of the wave?

A $v = \sqrt{\left(\frac{gL}{2\pi}\right)}$ **B** $v = \frac{gL}{4\pi^2}$ **C** $v = 2\pi\sqrt{\left(\frac{g}{L}\right)}$ **D** $v = \frac{2\pi g}{L}$

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34. 9702_w19_qp_12 Q: 2

Which expression gives an SI base quantity?

A charge per unit time

B force per unit area

C mass per unit volume

D work done per unit distance

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35. 9702_w19_qp_13 Q: 1

Which quantity with its unit is correct?

A acceleration of a bicycle = 1.4 m s^{-1}

B electric current in a lamp = 0.25 A s^{-1}

C electric potential difference across a battery = 8.0 J C^{-1}

D kinetic energy of a car = 4500 N m^{-1}

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36. 9702_w19_qp_13 Q: 2

Which two units are **not** equivalent to each other?

A N m and kg m^2 s^{-2}

B N s and kg m s^{-1}

C J s^{-1} and kg m^2 s^{-3}

D Pa and kg m s^{-2}

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37. 9702_m18_qp_12 Q: 1

Which unit is equivalent to the coulomb?

A ampere per second

B joule per volt

C watt per ampere

D watt per volt

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38. 9702_m18_qp_12 Q: 2

Which row shows a quantity and an **incorrect** unit?

	quantity	unit
A	efficiency	no unit
B	moment of force	N m^{-1}
C	momentum	N s
D	work done	J

---

39. 9702_s18_qp_12 Q: 2

The drag coefficient C_d is a number with no units. It is used to compare the drag on different cars at different speeds. C_d is given by the equation

$$C_d = \frac{2F}{v^n \rho A}$$

where F is the drag force on the car, ρ is the density of the air, A is the cross-sectional area of the car and v is the speed of the car.

What is the value of n?

A 1 **B** 2 **C** 3 **D** 4

---

40. 9702_w18_qp_11 Q: 2

When a beam of light is incident on a surface, it delivers energy to the surface. The intensity of the beam is defined as the energy delivered per unit area per unit time.

What is the unit of intensity, expressed in SI base units?

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

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41. 9702_w18_qp_12 Q: 2

What is the unit of resistance when expressed in SI base units?

A $\mathrm{kg\,m^{2}\,s^{-2}\,A^{-1}}$

B $\mathrm{kg\,m^{2}\,s^{-3}\,A^{-2}}$

C $\mathrm{kg\,m\,s^{-2}\,A^{-1}}$

D $\mathrm{kg\,m\,s^{-3}\,A^{-1}}$

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42. 9702_w18_qp_13 Q: 2

Three of these quantities have the same unit.

Which quantity has a different unit?

A $\dfrac{\text{energy}}{\text{distance}}$

B force

C power $\times$ time

D rate of change of momentum

---

43. 9702_m17_qp_12 Q: 1

Which expression has the same SI base units as pressure?

A $\dfrac{\text{force}}{\text{length} \times \text{speed}}$

B $\dfrac{\text{force}}{\text{length} \times \text{time}}$

C $\dfrac{\text{mass}}{\text{length} \times (\text{time})^2}$

D $\dfrac{\text{mass} \times (\text{time})^2}{\text{length}}$

---

44. 9702_s17_qp_12 Q: 3

What correctly expresses the volt in terms of SI base units?

A $\mathrm{A\,\Omega}$

B $\mathrm{W\,A^{-1}}$

C $\mathrm{kg\,m^2\,s^{-1}\,A^{-1}}$

D $\mathrm{kg\,m^2\,s^{-3}\,A^{-1}}$

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45. 9702_s17_qp_13 Q: 3

Which expression using SI base units is equivalent to the volt?

A $\mathrm{kg\,m^2\,s^{-1}\,A^{-1}}$

B $\mathrm{kg\,m\,s^{-2}\,A}$

C $\mathrm{kg\,m^2\,s^{-1}\,A}$

D $\mathrm{kg\,m^2\,s^{-3}\,A^{-1}}$

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46. 9702_w17_qp_11 Q: 1

Which SI unit, expressed in base units, is **not** correct?

A unit of force, $\mathrm{kg\,m\,s^{-2}}$

B unit of momentum, $\mathrm{kg\,m\,s^{-1}}$

C unit of pressure, $\mathrm{kg\,m^{-2}\,s^{-2}}$

D unit of work, $\mathrm{kg\,m^2\,s^{-2}}$

---

47. 9702_w17_qp_12 Q: 1

Which pair of units are **not** the same when expressed in SI base units?

A $\mathrm{m\,s^{-2}}$ and $\mathrm{N\,kg^{-1}}$

B $\mathrm{N\,s}$ and $\mathrm{kg\,m\,s^{-1}}$

C Pa and $\mathrm{N\,m^{-2}}$

D $\mathrm{V\,m^{-2}}$ and $\mathrm{N\,C^{-1}}$

---

48. 9702_w17_qp_12 Q: 3

The units of specific heat capacity are $J\,kg^{-1}\,K^{-1}$.

What are the SI base units of specific heat capacity?

A $m\,s^{-2}\,K^{-1}$ **B** $m\,s^{-1}\,K^{-1}$ **C** $m^2\,s^{-2}\,K^{-1}$ **D** $m^2\,s^{-1}\,K^{-1}$

---

49. 9702_w17_qp_13 Q: 1

How many cubic nanometres, nm^3, are in a cubic micrometre, μm^3?

A 10^3 **B** 10^6 **C** 10^9 **D** 10^{12}

---

50. 9702_w17_qp_13 Q: 2

The maximum theoretical power P of a wind turbine is given by the equation

$$P = k\rho A v^n$$

where ρ is the density of air, A is the area swept by the turbine blades, v is the speed of the air and k is a constant with no units.

What is the value of n?

A 1 **B** 2 **C** 3 **D** 4

---

51. 9702_m16_qp_12 Q: 1

The prefixes nano (n), micro (μ) and pico (p) are often used with units.

Which row shows their correct values?

	n	μ	p
A	10^{-6}	10^{-9}	10^{-12}
B	10^{-6}	10^{-12}	10^{-9}
C	10^{-9}	10^{-6}	10^{-12}
D	10^{-12}	10^{-9}	10^{-6}

---

52. 9702_m16_qp_12 Q: 3

The SI unit of specific heat capacity is $J\,kg^{-1}\,K^{-1}$.

What is the unit of specific heat capacity expressed in SI base units?

A $m\,s^{-2}\,K^{-1}$ **B** $kg\,m\,s^{-1}\,K^{-1}$ **C** $m^2\,s^{-2}\,K^{-1}$ **D** $kg\,m^2\,s^{-1}\,K^{-1}$

---

53. 9702_s16_qp_11 Q: 2

Which pair of quantities do **not** have the same SI base units?

A electromotive force and electric potential difference

B pressure and stress

C spring constant and moment of a force

D torque and work

---

54. 9702_s16_qp_12 Q: 2

The luminosity L of a star is given by

$$L = 4\pi r^2 \sigma T^4$$

where

r is the radius of the star,

T is the temperature of the star,

σ is a constant with units $\mathrm{W\,m^{-2}K^{-4}}$.

What are the SI base units of L?

A $\mathrm{kg\,m^2\,s^{-1}}$ **B** $\mathrm{kg\,m^2\,s^{-2}}$ **C** $\mathrm{kg\,m^2\,s^{-3}}$ **D** $\mathrm{kg\,m^2\,s^{-4}}$

---

55. 9702_s16_qp_13 Q: 1

Which list contains only SI base units?

A ampere, kelvin, joule, gram

B kilogram, newton, metre, ampere

C metre, coulomb, second, kelvin

D second, kelvin, ampere, kilogram

---

56. 9702_s16_qp_13 Q: 2

The stress σ needed to fracture a particular solid is given by the equation

$$\sigma = k\sqrt{\frac{\gamma E}{d}}$$

where E is the Young modulus, d is the distance between planes of atoms, and k is a constant with no units.

What are the SI base units of γ?

A $\mathrm{kg\,m\,s^{-2}}$ **B** $\mathrm{kg\,s^{-2}}$ **C** $\mathrm{kg\,m\,s^{-1}}$ **D** $\mathrm{kg\,s^{-1}}$

---

57. 9702_w16_qp_11 Q: 2

The force F between two point charges q_1 and q_2, a distance r apart, is given by the equation

$$F = \frac{kq_1q_2}{r^2}$$

where k is a constant.

What are the SI base units of k?

A $kg\,m^3\,s^{-4}\,A^2$ **B** $kg\,m^3\,s^{-4}\,A^{-2}$ **C** $kg\,m^3\,A^2$ **D** $kg\,m^3\,A^{-2}$

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58. 9702_w16_qp_12 Q: 1

Concrete has a density of $2400\,kg\,m^{-3}$.

Which mass of concrete fills a rectangular space of dimensions $8.0\,cm \times 90\,cm \times 110\,cm$?

A 79 kg **B** 190 kg **C** 790 kg **D** 1900 kg

---

59. 9702_w16_qp_12 Q: 2

The speed v of sound in a gas is given by the equation

$$v = \sqrt{\frac{\gamma P}{\rho}}$$

where P is the pressure of the gas, ρ is its density and γ is a constant.

What are the SI base units of γ?

A $m^{-1}\,s$ **B** $m^3\,s^{-3}$ **C** $m^{-4}\,s^{-4}$ **D** no units

---

60. 9702_w16_qp_13 Q: 2

The force F between two point charges q_1 and q_2, a distance r apart, is given by the equation

$$F = \frac{kq_1q_2}{r^2}$$

where k is a constant.

What are the SI base units of k?

A $kg\,m^3\,s^{-4}\,A^2$ **B** $kg\,m^3\,s^{-4}\,A^{-2}$ **C** $kg\,m^3\,A^2$ **D** $kg\,m^3\,A^{-2}$

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61. 9702_s15_qp_11 Q: 1

Which is an SI base unit?

A current

B gram

C kelvin

D volt

---

62. 9702_s15_qp_11 Q: 3

When a constant braking force is applied to a vehicle moving at speed v, the distance d moved by the vehicle in coming to rest is given by the expression

$$d = kv^2$$

where k is a constant.

When d is measured in metres and v is measured in metres per second, the constant has a value of k_1.

What is the value of the constant when the distance is measured in metres, and the speed is measured in kilometres per hour?

A $0.0772\,k_1$ **B** $0.278\,k_1$ **C** $3.60\,k_1$ **D** $13.0\,k_1$

---

63. 9702_s15_qp_12 Q: 1

Which definition is correct and uses only quantities rather than units?

A Density is mass per cubic metre.

B Potential difference is energy per unit current.

C Pressure is force per unit area.

D Speed is distance travelled per second.

---

64. 9702_s15_qp_12 Q: 2

The average kinetic energy E of a gas molecule is given by the equation

$$E = \tfrac{3}{2}kT$$

where T is the absolute (kelvin) temperature.

What are the SI base units of k?

A $\mathrm{kg^{-1}\,m^{-1}\,s^{2}\,K}$

B $\mathrm{kg^{-1}\,m^{-2}\,s^{2}\,K}$

C $\mathrm{kg\,m\,s^{-2}\,K^{-1}}$

D $\mathrm{kg\,m^{2}\,s^{-2}\,K^{-1}}$

---

65. 9702_s15_qp_13 Q: 1

Which statement includes a correct unit?

A energy = 7.8 N s

B force = 3.8 N s

C momentum = 6.2 N s

D torque = 4.7 N s

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66. 9702_s15_qp_13 Q: 2

What is the joule (J) in SI base units?

A $\mathrm{kg\,m\,s^{-1}}$ **B** $\mathrm{kg\,m^{2}\,s^{-1}}$ **C** $\mathrm{kg\,m\,s^{-2}}$ **D** $\mathrm{kg\,m^{2}\,s^{-2}}$

1.3 Scalars and vectors

67. 9702_m20_qp_12 Q: 3

Which pair of quantities contains both a scalar **and** a vector?

A acceleration and momentum

B charge and resistance

C kinetic energy and mass

D temperature and velocity

---

68. 9702_s20_qp_11 Q: 3

The power produced by a force moving an object is given by the equation shown.

$$\text{power} = \frac{\text{work}}{\text{time}} = \frac{\text{force} \times \text{displacement}}{\text{time}}$$

Which quantities are scalars and which are vectors?

	scalars	vectors
A	displacement, time	force, power
B	power, work	displacement, force
C	power, force	displacement, work
D	work, time	power, displacement

---

69. 9702_s20_qp_12 Q: 2

Which quantity is a scalar?

A acceleration

B force

C kinetic energy

D momentum

---

70. 9702_s20_qp_13 Q: 3

Which characteristics are possessed by a vector quantity but **not** by a scalar quantity?

A direction only

B magnitude and direction

C magnitude and unit

D unit only

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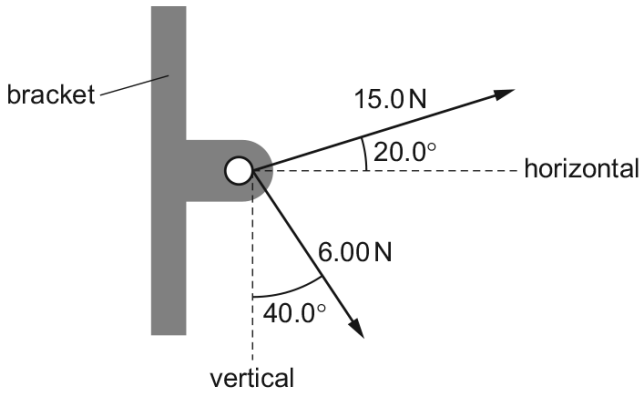
71. 9702_s19_qp_12 Q: 4

Two cables are attached to a bracket and exert forces as shown.

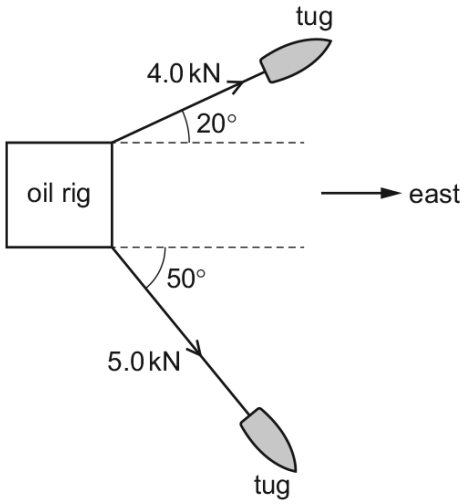


What are the magnitudes of the horizontal and vertical components of the resultant of the two forces?

	horizontal component / N	vertical component / N
A	9.73	0.534
B	9.73	10.2
C	18.0	0.534
D	18.0	10.2

72. 9702_s19_qp_13 Q: 3

Two tugs are towing an oil rig as shown.



The tensions in the towing cables are 4.0 kN and 5.0 kN.

What is the total force acting on the rig due to the cables, in the direction to the east?

A 3.1 kN **B** 5.2 kN **C** 7.0 kN **D** 7.3 kN

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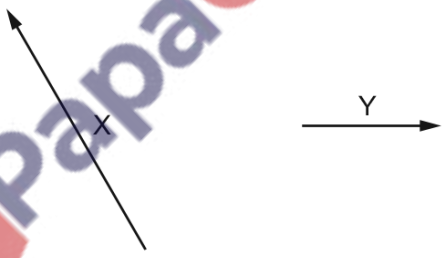
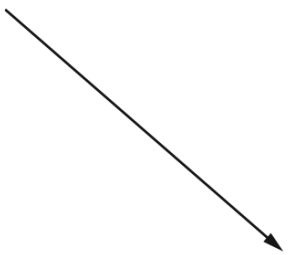
73. 9702_w19_qp_11 Q: 3

The diagram shows two vectors X and Y, drawn to scale.

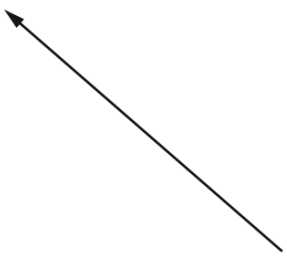


If X = Y + Z, which diagram best represents the vector Z?

A



B



C

D

---

74. 9702_w19_qp_12 Q: 3

Which list contains only scalar quantities?

A area, length, displacement

B kinetic energy, speed, power

C potential energy, momentum, time

D velocity, distance, temperature

---

75. 9702_w19_qp_13 Q: 3

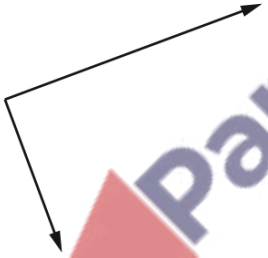
The arrow represents a vector R.

Which diagram does **not** represent R as two perpendicular components?

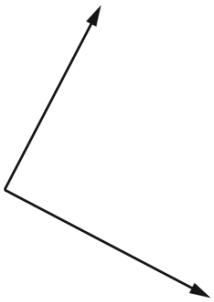
A

B

C



D



---

76. 9702_m18_qp_12 Q: 3

Two forces of equal magnitude are represented by two coplanar vectors. One is directed towards the east and the other is directed towards the north.

What is the direction of a single force that will balance these two forces?

A towards the north-east

B towards the north-west

C towards the south-east

D towards the south-west

---

77. 9702_m18_qp_12 Q: 5

A person calculates the potential difference across a wire by using the measurements shown.

Which measured quantity has the greatest contribution to the percentage uncertainty in the calculated potential difference?

	quantity	value	uncertainty
A	current / A	5.0	± 0.5
B	diameter of wire / mm	0.8	± 0.1
C	length of wire / m	150	± 5
D	resistivity of metal in wire / Ω m	1.6×10^{-8}	$\pm 0.2 \times 10^{-8}$

---

78. 9702_s18_qp_11 Q: 2

Physical quantities can be classed as vectors or as scalars.

Which pair of quantities consists of two vectors?

A kinetic energy and force

B momentum and time

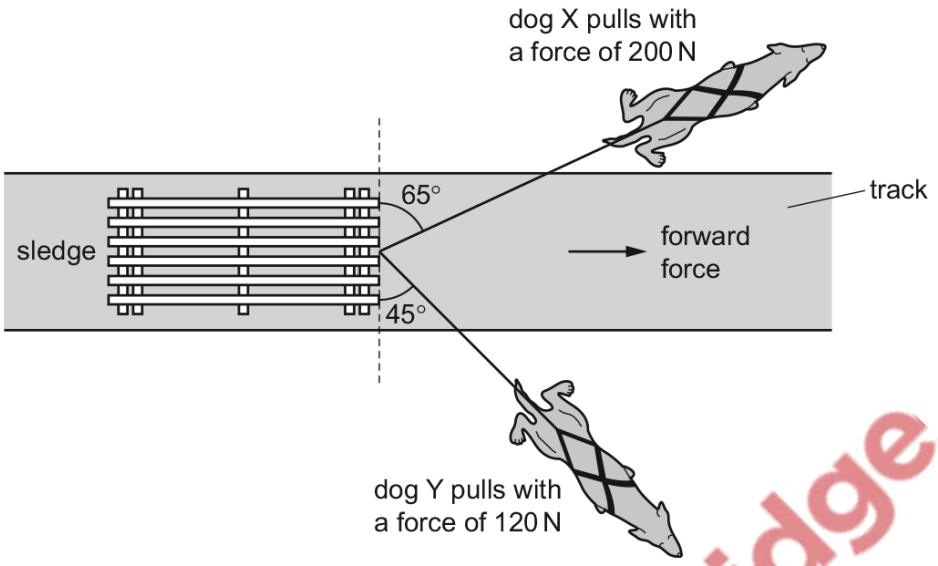
C velocity and electric field strength

D weight and temperature

---

79. 9702_s18_qp_11 Q: 3

Two dogs pull a sledge along an icy track, as shown.



Dog X pulls with a force of 200 N at an angle of 65° to the front edge of the sledge. Dog Y pulls with a force of 120 N at an angle of 45° to the front edge of the sledge.

What is the resultant forward force on the sledge exerted by the two dogs?

A 80 N **B** 170 N **C** 270 N **D** 320 N

---

80. 9702_s18_qp_13 Q: 2

Which pair includes a vector quantity and a scalar quantity?

A displacement and acceleration

B force and kinetic energy

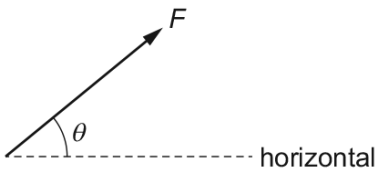
C power and speed

D work and potential energy

---

81. 9702_s18_qp_13 Q: 3

A force F acts at an angle θ to the horizontal.



What are the horizontal and the vertical components of the force?

	horizontal component	vertical component
A	$F\cos\theta$	$F\cos(90° - \theta)$
B	$F\cos\theta$	$F\sin(90° - \theta)$
C	$F\sin\theta$	$F\cos\theta$
D	$F\sin\theta$	$F\cos(90° - \theta)$

---

82. 9702_w18_qp_11 Q: 3

A ship is travelling with a velocity of 8.0 km h^{-1} in a direction 30° east of north.

What are the components of the ship's velocity in the east and north directions?

	component of velocity in east direction / km h^{-1}	component of velocity in north direction / km h^{-1}
A	4.0	4.0
B	4.0	6.9
C	4.6	6.9
D	6.9	4.0

---

83. 9702_w18_qp_12 Q: 3

Which list contains both scalar and vector quantities?

A acceleration, momentum, velocity, weight

B area, current, force, work

C distance, kinetic energy, power, pressure

D mass, temperature, time, speed

---

84. 9702_w18_qp_12 Q: 4

Vectors P and Q are drawn to scale.

Which diagram represents the vector (P + Q)?

A

B

C

D

---

85. 9702_w18_qp_13 Q: 3

Which group of quantities contains only vectors?

A acceleration, displacement, speed

B acceleration, work, electric field strength

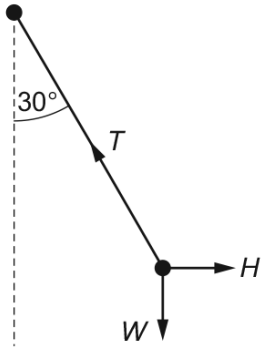
C displacement, force, velocity

D power, electric field strength, force

---

86. 9702_m17_qp_12 Q: 3

A pendulum bob is held stationary by a horizontal force *H*. The three forces acting on the bob are shown in the diagram.



The tension in the string of the pendulum is *T*. The weight of the pendulum bob is *W*. The string is held at an angle of 30° to the vertical.

Which statement is correct?

A $H = T\cos 30$

B $T = H\sin 30$

C $W = T\sin 30$

D $W = T\cos 30$

---

87. 9702_s17_qp_11 Q: 2

A particle travels in a straight line with speed *v*.

The particle slows down and changes direction. The new speed of the particle is $\frac{v}{2}$.

The new velocity has a component of $\frac{v}{4}$ in the same direction as the initial path of the particle.

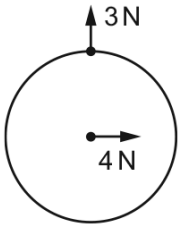
Through which angle has the particle turned?

A 27° **B** 30° **C** 45° **D** 60°

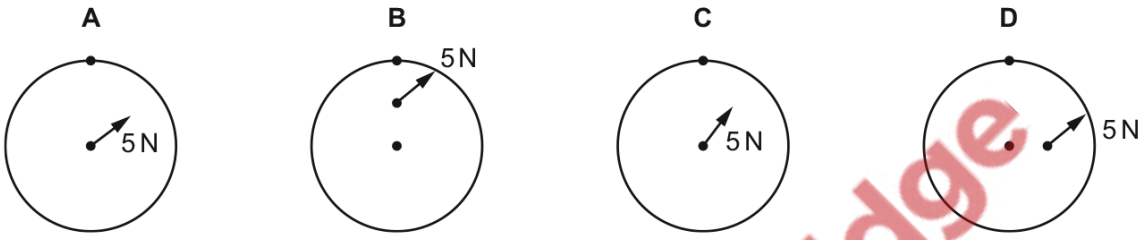
---

88. 9702_s17_qp_12 Q: 2

Two forces act on a circular disc as shown.



Which diagram shows the line of action of the resultant force?



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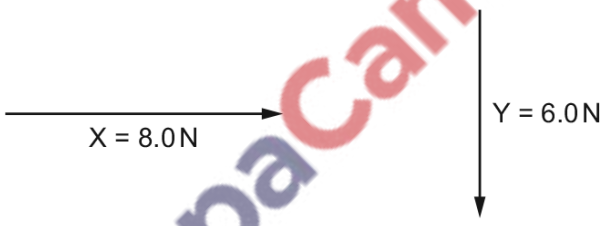
89. 9702_s17_qp_13 Q: 2

The diagram shows two vectors X and Y. The vectors are perpendicular to one another.



What is the magnitude and direction of vector (X – Y)?

A 10.0N at an angle of 37° downwards from the direction of X

B 10.0N at an angle of 37° upwards from the direction of X

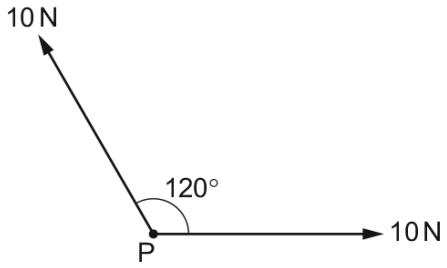
C 14.0N at an angle of 53° downwards from the direction of X

D 14.0N at an angle of 53° upwards from the direction of X

---

90. 9702_w17_qp_11 Q: 2

Two forces, each of 10 N, act at a point P as shown. The angle between the directions of the forces is 120°.



What is the magnitude of the resultant force?

A 5 N **B** 10 N **C** 17 N **D** 20 N

---

91. 9702_w17_qp_11 Q: 6

In still air, a bird can fly at a speed of 10 m s^{-1}. The wind is blowing from the east at 8.0 m s^{-1}.

In which direction must the bird fly in order to travel to a destination that is due north of the bird's current location?

A 37° east of north

B 37° west of north

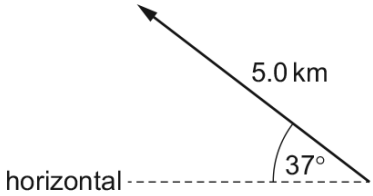
C 53° east of north

D 53° west of north

---

92. 9702_w17_qp_12 Q: 2

What is the vertical component of this displacement vector?

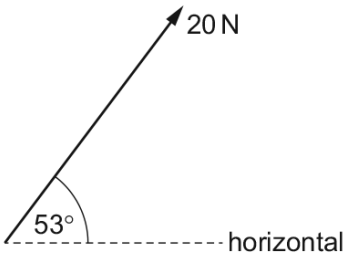


A 3.0 km **B** 3.8 km **C** 4.0 km **D** 5.0 km

---

93. 9702_w17_qp_13 Q: 3

What is the horizontal component of the force shown?

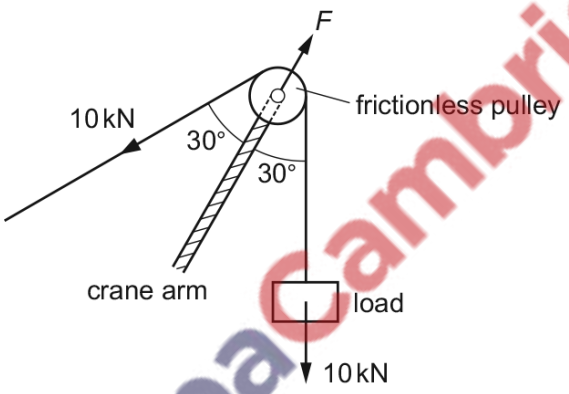


A 12 N **B** 16 N **C** 20 N **D** 27 N

---

94. 9702_m16_qp_12 Q: 2

A crane has an arm to which is attached a frictionless pulley. A cable passes over the pulley and supports a load of 10 kN as shown.



The crane arm exerts a force F on the pulley.

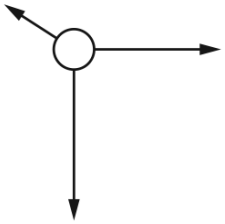
What is the value of F?

A 5.0 kN **B** 8.7 kN **C** 10 kN **D** 17 kN

---

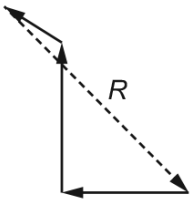
95. 9702_s16_qp_11 Q: 1

Three wires each exert a horizontal force on a vertical pole, as shown.

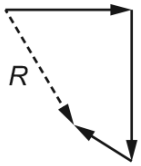


Which vector diagram shows the resultant force *R* acting on the pole?

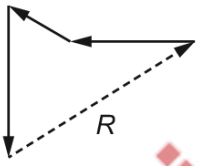
A



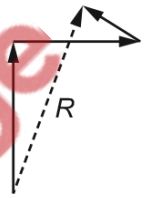
B



C



D



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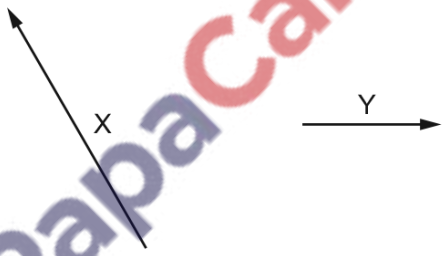
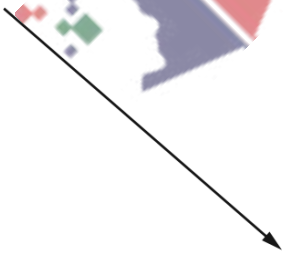
96. 9702_s16_qp_12 Q: 3

The diagram shows two vectors X and Y, drawn to scale.

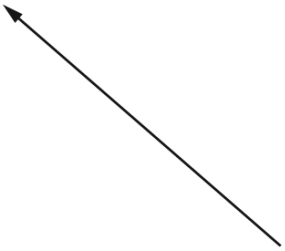


If X = Y – Z, which diagram best represents the vector Z?

A



B



C

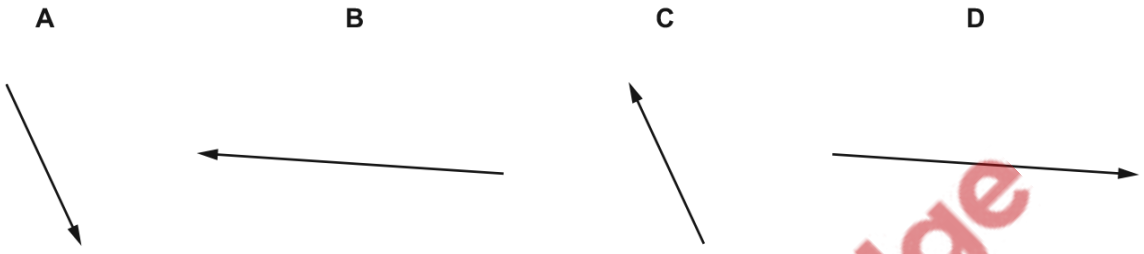
D

---

97. 9702_s16_qp_13 Q: 3

Vectors P and Q are drawn to scale.

Which diagram represents the vector (P – Q)?



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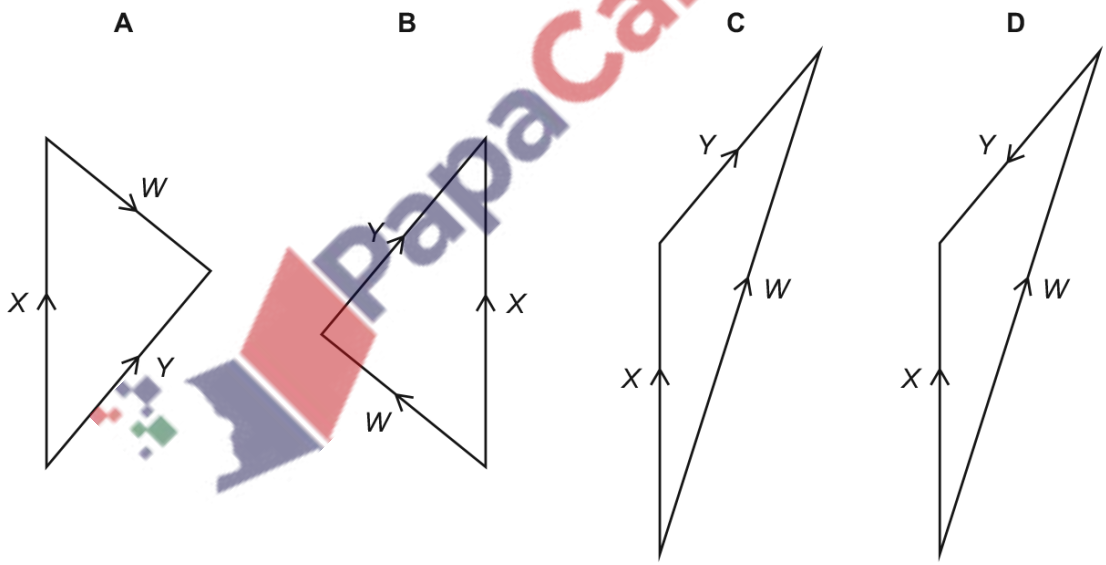
98. 9702_w16_qp_11 Q: 3

An aeroplane can fly at a velocity *X* when moving through still air. When flying in wind the aeroplane's velocity relative to the ground is *Y*.

Which vector diagram shows the magnitude and direction of the wind velocity *W*?



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99. 9702_w16_qp_12 Q: 3

The motion of an object moving from rest with a constant acceleration a may be represented by the equation shown.

$$v^2 = 2as$$

Which row describes the quantities represented by the symbols v and s?

	v	s
A	scalar	scalar
B	scalar	vector
C	vector	scalar
D	vector	vector

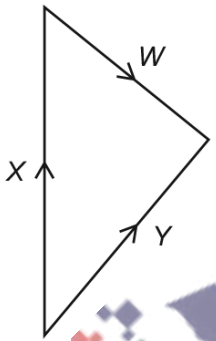
---

100. 9702_w16_qp_13 Q: 3

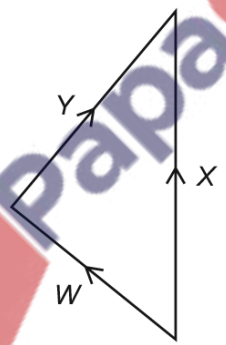
An aeroplane can fly at a velocity X when moving through still air. When flying in wind the aeroplane's velocity relative to the ground is Y.

Which vector diagram shows the magnitude and direction of the wind velocity W?

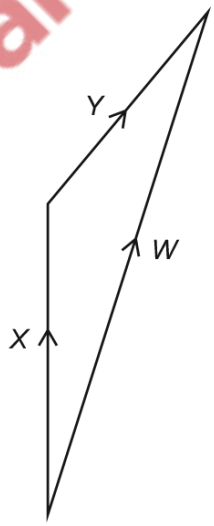
A



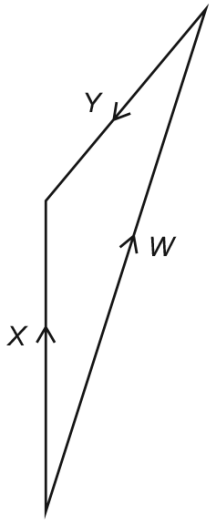
B



C



D



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101. 9702_s15_qp_11 Q: 2

Which pair contains one vector and one scalar quantity?

A displacement acceleration

B force kinetic energy

C momentum velocity

D power speed

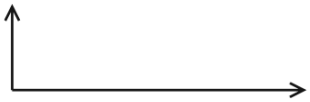
---

102. 9702_s15_qp_12 Q: 4

The arrow represents the vector R.

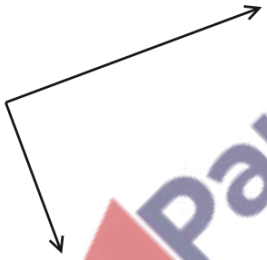
Which diagram does **not** represent R as two perpendicular components?

A

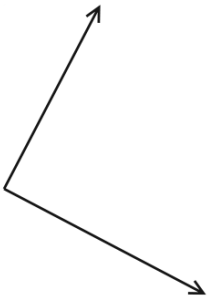


B

C



D



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103. 9702_s15_qp_13 Q: 3

The speed of an aeroplane in still air is 200 km h^{-1}. The wind blows from the west at a speed of 85.0 km h^{-1}.

In which direction must the pilot steer the aeroplane in order to fly due north?

A 23.0° east of north

B 23.0° west of north

C 25.2° east of north

D 25.2° west of north
