A-Level Physics: **w25 11**

Question 1 (Answer: **D**)

- Acceleration is the only vector here – it is a rate of change of velocity.
- Charge, kinetic energy and wavelength are all scalars.
- Charge can be negative, but a sign is not a direction in space.

Question 4 (Answer: **C**)

- Two equal forces give a resultant along the bisector of the angle between them.
- $R = 2F\cos(\theta/2) = 2 \times 6.0 \times \cos 30° = 10.4$ N.
- D would need the forces parallel; A would need 120° between them.

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1(a)(i)	v_H = 28 × cos 34° = 23 m s^{-1}
	v_V = 28 × sin 34° = 16 m s^{-1}
1(a)(ii)	time = 16 / 9.81 = 1.6 s
1(a)(iii)	horizontal straight line at v = 23 m s^{-1} from t = 0 to t = 3.2 s
1(a)(iv)	straight diagonal line starting at a positive velocity from t = 0 to t = 3.2 s, crossing the time axis
	line starting at v = 16 m s^{-1} and ending at v = –16 m s^{-1}
	line passing through v = 0 at t = 1.6 s
1(b)(i)	product of mass and velocity
1(b)(ii)	F = Δp / t
	= 13 / 3.2 = 4.1 N
1(b)(iii)	m = Δp / v = 13 / (2 × 16) = 0.41 kg **or** m = F / g = 4.06 / 9.81 = 0.41 kg

Question 1 (Answer: **C**)

- Weight is a force, and every force has a direction as well as a size.
- Pressure, temperature and work are all scalars.
- Work is a product of two vectors that yields a scalar, so it has no direction of its own.

Question 4 (Answer: **B**)

- X points up and to the right, Y down and to the right, at equal angles.
- In X + Y the vertical parts cancel and the horizontal parts add, so it points to the right.
- −Y points up and to the left, so in X − Y the horizontal parts cancel and X − Y points up.

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Question 4 (Answer: **C**)

- X sits 30 mm from YZ, because $\sqrt{50^2 - 40^2} = 30$ mm.
- Each half of the elastic pulls along its own 50 mm length, so its component along P is $4.0 \times 30/50 = 2.4$ N.
- Both halves pull the same way along P, so the total is $2 \times 2.4 = 4.8$ N.

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1(a)	acceleration and displacement identified as vectors (and no others)
	speed, temperature and gravitational potential energy identified as scalars (and no others)
1(b)(i)	$W = Fs$ **or** $W = mas$
	$s = v^2 / 2a$ **or** $a = v^2 / 2s$ **or** $as = v^2 / 2$
	$W = ma(v^2 / 2a)$ **or** $W = m(v^2 / 2s)s$ **or** $W = m(v^2 / 2)$ **and** (so E_K)= $½mv^2$
	OR $W = Fs$ or $W = mas$
	$F = mv / t$ **and** $s = ½vt$
	$W = mv / t \times ½vt$ **and** (so E_K)= $½mv^2$
	OR $W = Fs$ or $W = mas$
	$a = v / t$ **and** $s = ½vt$
	$W = m(v / t)(½vt)$ **and** (so E_K)= $½mv^2$
	OR $W = Fs$ **or** $W = mas$
	$a = v / t$ **and** $s = ½at^2$
	$W = m(v / t)(½ \times (v / t) \times t^2)$ **and** (so E_K)= $½mv^2$

1(b)(ii)	kinetic energy $= \frac{1}{2} mv^2$ $= \frac{1}{2} \times 920 \times 17^2$ $= 1.3 \times 10^5$ J
1(b)(iii)	$P = W/t$
	$= (4.7 \times 10^4 + 1.3 \times 10^5) / 5.8$
	$= 3.1 \times 10^4$ W
1(b)(iv)	(at/after t = 5.8 s) the kinetic energy (of the car) does not change / work is done only against resistive forces / no work is done to accelerate (the car) so (power output is) less