QCAA ALTERNATIVE SEQUENCE PHYSICS MOCK "SCHOOL USE ONLY" EXTERNAL EXAM – 2020

MULTIPLE CHOICE QUESTIONS - SOLUTIONS AND EXPLANATIONS

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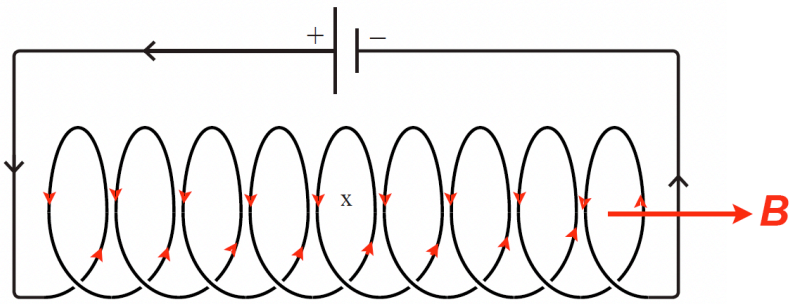
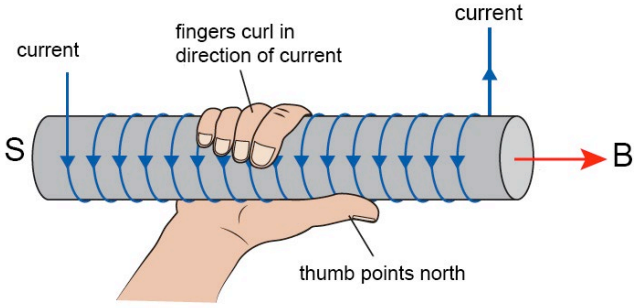
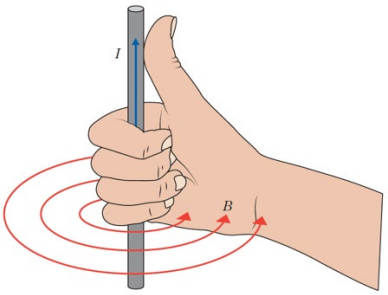
Q		Reasons
1	A	Incorrect. Used $T_K = 273 - T_C$
	B*	Correct $T_K = T_C + 273$ $T_C = T_K - 273$ $= 296 - 273 = 23^\circ C$
	C	Incorrect. Used $T_K = T_C + 271$
	D	Incorrect. Used $T_C = T_K + 273$
2	A*	Correct. Heat radiates out by electromagnetic waves, e. g. infrared radiation
	B	Incorrect. This is nuclear radiation, e. g. alpha radiation, gamma radiation
	C	Incorrect. This is conduction
	D	Incorrect. This is convection
3	A	Incorrect. This has the symbol E_K
	B	Incorrect. This has the symbol λ
	C*	Correct. This is the definition of work function, W
	D	Incorrect. This is the ionization energy and had no specific symbol.
4	A	Incorrect. Forgot to convert 10 cm to 0.10 m. Hence: $B = \frac{\mu_o I}{2\pi r} = \frac{4\pi \times 10^{-7} I}{2\pi r} = \frac{2 \times 10^{-7} I}{r} = \frac{2 \times 10^{-7} \times 2}{10} = 4 \times 10^{-8}\ T$
	B*	Correct $B = \frac{\mu_0 I}{2\pi r} = \frac{2 \times 10^{-7} \times 2}{2\pi \times 0.10} = 4 \times 10^{-6}\ \text{T}$
	C	Incorrect. Probably converted 10 cm wrongly to 0.10×10^{-6} m, hence: $B = \frac{\mu_o I}{2\pi r} = \frac{4\pi \times 10^{-7} I}{2\pi r} = \frac{2 \times 10^{-7} I}{r} = \frac{2 \times 10^{-7} \times 2}{0.10 \times 10^{-6}} = 4\ T$
	D	Incorrect. Converted 10 cm wrongly to 10×10^{-9} m, hence: $B = \frac{\mu_o I}{2\pi r} = \frac{4\pi \times 10^{-7} I}{2\pi r} = \frac{2 \times 10^{-7} I}{r} = \frac{2 \times 10^{-7} \times 2}{10 \times 10^{-9}} = 40\ T$
5	A	Incorrect. Forgot to convert 100 g to kg
	B*	Correct $Q = mc\Delta T$ $c = \frac{Q}{m(T_f - T_i)} = \frac{1000}{0.100 \times (90 - 40)}$ $= 200\ \text{J kg}^{-1}\text{K}^{-1}$

	C	Incorrect. Rearranged to $c = \frac{Q\,\Delta T}{m}$ and didn't convert 100 g to kg
	D	Incorrect. Rearranged to $c = m\,Q\,\Delta T$
6	A*	Correct. The full syllabus definition is: *the amount of time one cycle or one event takes to occur; the length of time taken for one wavelength to pass a given point; in circular motion, period refers to the time taken to complete one revolution (symbol, TT; SI unit, s).*
	B	Incorrect. This is a trap to make you think of the time it takes a particle on a wave to be in the same consecutive equilibrium positions, but this is only half a cycle and so half a period.
	C	Incorrect. This is about the distance not the time (period). It would be true if it said, "the time taken to travel the distance of one revolution in uniform circular motion".
	D	Incorrect. This is about the distance not the time (period). It would be true if it said, "the time taken by a wave when one whole wavelength passes a given point".
7	A*	Correct. P_{in} =200 kW, P_{out} = 140 kW, P_{lost} = 60 kW, $\eta = \frac{140}{200} \times 100 = 70\%$
	B	Incorrect. The efficiency η = 20%, not 80% as stated. $P_{in} = 200\text{kW}, P_{out} = 40\text{kW}, P_{lost} = 160\,\text{kW}$ $\eta = \frac{P_{out}}{P_{in}} \times 100 = \frac{40}{200} \times 100 = 20\%$
	C	Incorrect. P_{lost} = +20 kW not –20 kW to have an efficiency of +90%.
	D	Incorrect. The power lost = 0 kW which means the system is 100% efficient. The question says "realistic scenario" and this is unrealistic. Option A is a better choice.
8	A	Incorrect. This is superposition
	B	Incorrect. This is refraction
	C	Incorrect. This is reflection
	D*	Correct. Definition of interference
9	A	Incorrect. Translational (emr)
	B*	Correct
	C	Incorrect. Translational (emr)
	D	Incorrect. Translational
10	A*	Correct. Definition
	B	Incorrect. This is the rate of flow of charge
	C	Incorrect. Resistance is the ratio of voltage to current
	D	Incorrect. This is the change in electric potential energy between two points in a circuit
11	A	Incorrect. This is an ammeter
	B	Incorrect. This is not a recognised symbol
	C	Incorrect. This is a voltmeter
	D*	Correct.
12	A	Incorrect. Power is W/t
	B	Incorrect. Charge is Q
	C*	Correct
	D	Incorrect. Potential difference is ΔV
13	A	Incorrect. Didn't convert cm to m.
	B*	Correct $\phi = BA = 0.28 \times 0.04 \times 0.04 = 4.48 \times 10^{-4}\,Wb$
	C	Incorrect. Didn't calculate the area as 0.04 m × 0.04 m but just said it was 0.04 m.
	D	Incorrect. The negative is relative and doesn't mean anything here. When faced with two plausible answers choose the simpler. The better alternative is thus Option B.

14	A*	Correct. Angle i = angle r which is consistent with the law of reflection.
	B	Incorrect. Angle $i \neq$ angle r which is consistent with the law of reflection.
	C	Angle $i \neq$ angle r which is inconsistent with the law of reflection.
	D	Angle i = angle r which is consistent with the law of reflection, but the incident ray (shown by the incoming arrow) is shown to have an angle r, not i.
15	A	Incorrect. The point X is not the tail feathers of an arrow pointing into the page. This was meant to trap you.
	B	Incorrect. There is no logical reason for choosing this.
	C	Incorrect. This answer incorrectly uses either your left hand or not understanding the way the current flows in the diagram. I have drawn arrows on the diagram below to show the current.
	D*	Correct. Here's an annotated drawing. The current flows down the front of the solenoid and up the back. It is not easy to decipher the diagram. Using the right-hand rule for solenoids, wrap the fingers of your right and around the solenoid so that your fingers curl in the direction of the current. Your thumb will point in the direction of the field.  
16	A	Incorrect. It is true that it is *emissions of energy as electromagnetic waves or moving subatomic particles*. It can consist of 'especially high-energy particles, that cause ionisation' but it doesn't always.
	B	Incorrect. This is electromagnetic induction
	C*	Correct. This is described in Oxford *Physics for Queensland* Lesson 8.7 page 369. Radiant energy (true); synchronised oscillations of electric and magnetic fields (true). What this means is that the electric and magnetic field waves are in phase (synchronised) so they oscillate together.
	D	Incorrect. This is thermal conduction
17	A	Incorrect. This is just the y-axis value when the line crosses the x-axis.
	B*	Correct. It looks like about 10.0×10^{14} Hz and this is close to Option B.
	C	Incorrect. Unsure of why this option may seem plausible.
	D	Incorrect. Unsure of why this option may seem plausible.
18	A*	Correct. $F = \frac{kQq}{r^2} = \frac{9\times10^9\times(1.6\times10^{-6})^2}{0.150^2} = 1.0$ N
	B	Incorrect. Used 10^{-3} for μ instead of 10^{-6}
	C	Incorrect. Didn't convert mm to m

	D	Incorrect. Didn't convert mm to m and didn't square Q
19	A*	Correct. Using Ampere's right-hand rule for current carrying conductors you place your thumb pointing up the page, and your fingers curl to the right in front of the wire.  From Oxford *New Century Physics for Queensland*, 2019, U3&4, page 187
	B	Incorrect. Field is always at right angles to direction of current. This diagram has it as being parallel.
	C	Incorrect. May have used left hand instead of right hand.
	D	Incorrect. Field should be anticlockwise if current is moving into the page as shown by the cross 'X'.
20	A	Incorrect. I can't see any plausible way of getting an answer like this. It is wrong anyway.
	B	Incorrect. Calculated ΔE as 2.1 + 5.1 = 7.2 eV
	C*	Correct. $\Delta E = -5.1 - -2.1 = -3\text{eV}$ $= 3 \times 1.6 \times 10^{-19}$ $= 4.8 \times 10^{-19}\text{J}$ $E = hf = \frac{hc}{\lambda}$ $\lambda = \frac{hc}{E} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{4.8 \times 10^{-19}}$ $= 4.141 \times 10^{-7}\text{m}$ $= 4.141 \times 10^{-7}\text{m} \times \frac{1\text{ nm}}{10^{-9}\text{m}}$ $= 414.1\text{ nm}$ Note: the option says 411.4 nm but this is a QCAA typo error.
	D	Incorrect. Used 2.1 eV as ΔE