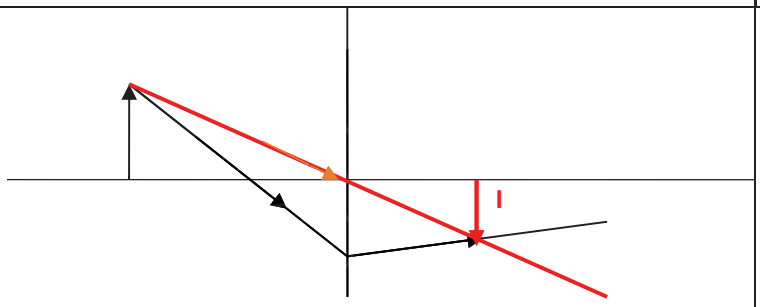
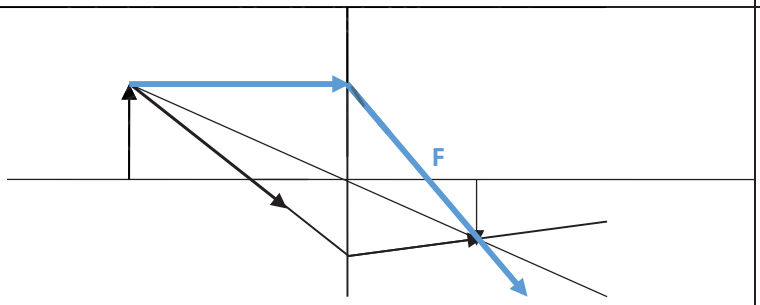
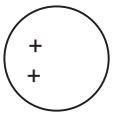
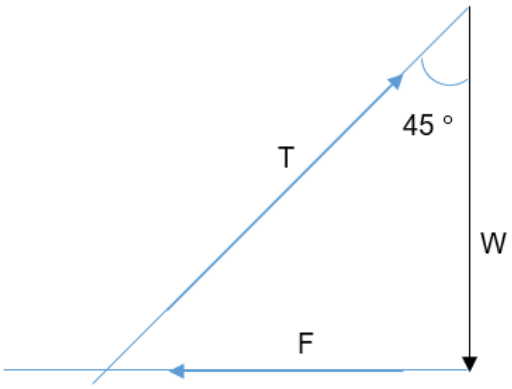
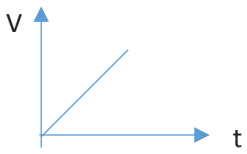
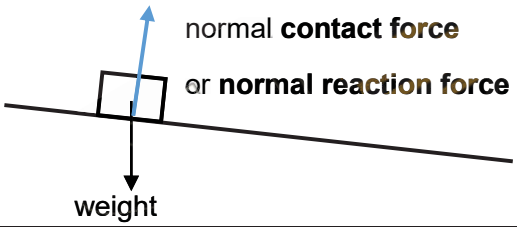
CWSS Prelim 2020
Physics P2 Answer

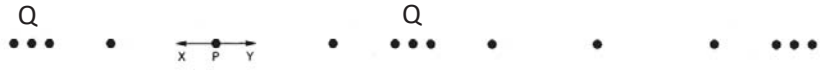
1	**(a)**	0 s to 10 s: constant velocity or displacement increases at a constant rate 10 s to 20 s: at rest or velocity = 0 20 s to 32 s: moving in **opposite direction** at **constant velocity** or velocity is constant and negative		1 1 1
	(b)	Anyone: • Infra-red radiation • Radio wave		1
			total	4
2	**(a)**	The **skateboarder's foot pushes the skateboard to the left/ backwards**, this causes the skateboard to move backwards/ to the left. By Newton's 3rd law, **the skateboard exerts a forward force**/ force towards the right acts **on the skateboarder** making him moves forwards/ to the right.		1 1
	(b)	**Chemical potential energy** to **kinetic energy**		1
	(c)	**(i)**	ke = ½ mv^2 = ½ x 42 x 0.30^2 = 1.89 = 1.9 J (2 s.f.)	 1 – working 1 – ans + unit + s.f.
		(ii)	The skateboarder exerts a **force on the air** with his body as he moves forwards and **move the air through a distance**.	1
		(iii)	Converted to **thermal energy** of the air.	1
			total	7
3	**(a)**	**The line of action of the weight** of the bus is on the left side of the wheel on the right. This creates an **anticlockwise moment** about the wheel on the right wheel. Hence it will not topple.		1 1
	(b)	The **c.g of the bus will be raised** if there are more passengers in the upper deck than lower deck. This will cause the bus to be less stable. Or The **c.g of the bus will be shifted more to one side of the bus** if there are more passengers seated on one side of the bus than the other side.		1

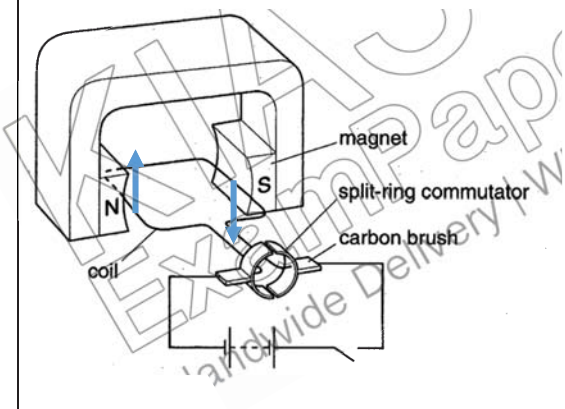
		This will cause the bus to be less stable when the bus turn on the side with more passengers.		
	(c)	**(i)**	Liquid is **incompressible**.	1
		(ii)	360/0.0012 = F/0.28 F = 84 000 N (2 s.f.)	1 - working 1 – ans + unit + s.f.
			total	6
4	**(a)**	**(i)**	n = 3.0 x 10^8 / speed of light in prism speed of light in prism = 3.0 x 10^8 / 1.6 = 1.9 x 10^8 m/s (2 s.f.)	1 – ans + unit + s.f.
		(ii)	n = 1 / sin c c = $\sin^{-1}$ (1/1.6) = 39° (2 s.f.)	1 working 1 ans and unit + s.f.
	(b)	**(i)**		1
		(ii)	 F must be marked clearly	1
		(iii)	Image will be dimmer	1
		(iv)	Move the lens further away from the object	1
			total	7

5	**(a)**	**Friction** causes **electrons/negative charges** to **move from the roller** to the **belt**. Excess negative charges on the belt caused it to be negatively charged		1 1
	(b)	The **electrons/negative charges in metal ball** is **repelled** by the negative charges on the dome through the conducting rod **to the Earth**. because **like charges repel**.		1 1
	(c)	 One or more positive charges drawn on the left side of the sphere.		 1
	(d)	**(i)**	**Region** in which an electric **charge** experiences a **force**.	1
		(ii)	$I = Q/t = 0.0016 \times 10^{-3} / 0.0012$ $= 0.0013$ A or 1.3×10^{-3} A (2 s.f.)	1 – working 1 – ans + unit
			total	8
6	**(a)**	**9.6 J of work** is done to drive 1 columb of charge/ **a unit charge** through the resistor.		1 1
	(b)	Current thru the bulb = current through reisstor = V/R = 9.6/ 40 =0.24 A		 1 – working 1 – ans + unit + s.f.
	(c)	$P = I^2R = 0.24^2 \times 10$ = 0.58 W (2.f.)		1 – working 1 – ans + unit + s.f.
	(d)	R **lowers the effective resistance** in the circuit and **increases the current through the bulb**. Since **$P = I^2R$**, **bulb** becomes **brighter** . Or R **lowers the effective resistance** across both the resistors in parallel and **lowers the p.d. difference across the resistors** and **increases the p.d. across the bulb**. Since **$P = V^2/R$**, **bulb** becomes **brighter** . Or R **lowers the effective resistance** in the circuit and **increases the current through the bulb.** This **increases the p.d. across the bulb**. Since **$P = IV$**, **bulb** becomes **brighter** .		1 1 1 1 1 1
			total	8

7	(a)	Any one: • to provide a **complete circuit** (with live) so that **current can flow** • to pass current back to mains • provide a return path for the current		
	(b)	when live touches metal case, **current flow to earth / earth wire / ground** or a short circuit is formed between the case and the earth. A large current flows, this causes **fuse to melt / blow and disconnects circuit / cuts live / stops current**		1 1
	(c)	doubly insulated or case / body made of plastic / insulator / not made of metal so user cannot touch the parts at high potential		1
			total	4
8	(a)	The iron ball is **magnetically induced** / becomes an induced magnet with **unlike pole facing the magnet**. Since **unlike poles attract**, the ball is **attracted** to the magnet.		1 1
	(b)	(i)	W = mg = 0.100 x 10 =1.0 N (1, 2 or 3 s.f.)	1 ans+unit
		(ii)	Weight drawn in correct direction to correct scale. Scale MUST be convenient and sufficiently large. Minimum Scale : 1 cm represents 0.2 N Magnetic force and Tension drawn at correct angle & direction with respect to weight. Clearly labelled. Final answer Force = 1.0 N ± (0.1 x scale)  	1 1 1

			total	6
9	**(a)**	**(i)**	Anyone: • The acceleration is constant • The speed of the carriage increases throughout the motion • The speed of the carriage increases at a slower rate initially compared to data 1.	1
		(ii)	distance = ½ x 2.00 x 2.50 = 2.50 m (3 s.f.) 	1 working 1 ans+unit + s.f.
		(iii)	Draw: **straight** line with **arrow in the correct direction** from the track and **90 °** to the track. Label : normal **contact force** or **force on carriage by the track** 	1
		(iv)	No difference the **gravitational potential energy of the carriage at the top of the track** is the **same** as **kinetic energy at the bottom of the track**. mgh = ½ mv^2 v = $\sqrt{(2gh)}$ or v is independent of the mass of the carriage	1 1
	(b)	**(i)**	a = (v-u)/t = (0.90-0)/0.20 or (1.8-0)/0.40 or (2.7-0)/0.60 =4.5 m/s^2 (2 s.f.)	1 working 1 ans+unit + s.f.
		(ii)	From t = 0.60 s to t= 1.20 s, **acceleration is zero/ the speed is constant**. when the carriage is on the horizontal/flat part of the track. This shows that the **resultant force is zero.** Hence track is **frictionless**.	1 1
			total	10
10	**(a)**	**(i)**	**Air molecules lose internal kinetic energy to the coolant** as it passes through. **thermal energy is absorbed by the coolant to weaken the forces of attraction between particles** of the coolant for the coolant to change from liquid to gaseous state / evaporate.	1 1

		(ii)	The coils **increase the surface area** exposed to the air. This **increases** the **rate of heat exchange** / heat absorption / rate of evaporation between the air and the coolant.	1 1
	(b)	Q = mcΔθ 1200 x 1 = 94 (35-T) T = 22 °C (2 s.f.)		1 working 1 ans+unit + 2 s.f.
	(c)	**Y** is more suitable Y has higher specific latent heat of vaporization, this allows it to draw the **more energy** from the air to **evaporate/ change state** and higher specific heat capacity, this allows it to **absorb more heat for each 1 ˚C increase/ unit change in temperature**.		1 – no mark if wrong liquid is selected 1 - no mark if wrong liquid is selected
	(d)	Black-painted copper Copper is a **good conductor of heat**. This enables heat to be conducted quickly from air to coolant. Black is **good absorber of radiation.** This enables heat to be absorbed quickly from air to coolant.		1 – no mark if material is identify wrongly 1 – no mark if material is identify wrongly
			total	10
11 Either				
(a)	**(i)**	Current in the coil makes it an **electromagnet**. This causes the coil to either **attract/ repel the permanent magnet**. or Current in the coil **creates a magnetic field** This **interacts with magnetic field** of the magnet that results in an unbalance magnetic field to **produce a force** acting on the coil.		1 1 1 1
	(ii)	Coil moves left and right/ into and out of magnet/ backwards and forwards. because current flow in one direction and then reverses hence reversing the force acting on the cone.		1 1
(b)	**(i)**	Distance between adjacent particles **varies from 0 to 3.0 mm** / increases and decreases/ decreases and increases		1 Ignore s.f.
	(ii)	Q Q  Accept answer between centre of two compressions/ rarefactions or distance between any 2 points moving in phase.		1

	(iii)	f = 1/T = 1/2.0 = 0.50 Hz	1 - ans + unit + s.f.
	(iv)	V = fλ = 0.5 x 0.4 = 0.2 m/s or 20 cm/s (1 or 2 s.f.)	1 – working 1- ans + unit + s.f.
	(vi)		1
		total	10
Or			
(a)	**(i)**	**Current** in the coil **creates a magnetic field** This **interacts with magnetic field** of the cylindrical magnet and resulted an unbalance magnetic field to **produce a force** acting on the wire.	1 1
	(ii)	Correct direction, must touch coil 	1
	(iii)	The **split ring commutator reverses the direction of the current in the coil after** it passes through its **vertical position**. This **reverses the direction of force on each side of the coil** allowing it to continue turning in same direction./ The **force on the coil next to the respective magnetic poles remain the same**.	1 1
(b)	**(i)**	Resultant moment = 2 x 4 x 0.05 = 0.4 Nm or 40 Ncm (1 or 2 s.f.)	1 – working 1- ans + unit + s.f.

	(ii)	The resultant moment **decreases** as coil rotates towards vertical position At the **vertical position, its moment = 0** As it rotates past the vertical position, the moment **increases** as it rotates towards horizontal position At **horizontal position, its moment = maximum or 0.40 Nm** again. Cycle repeats	1 1
(c)	Coil rotates faster.		1
		total	10