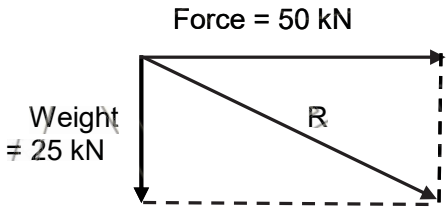
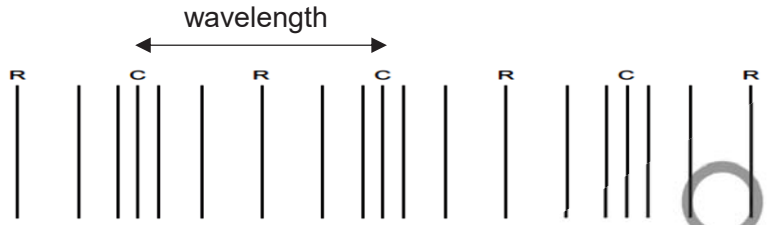
2019 Physics Prelim Paper 1

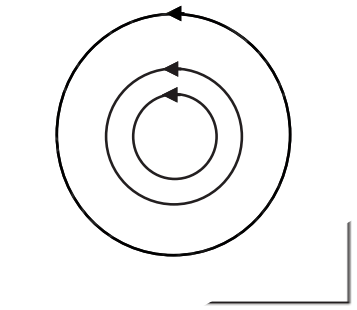
1	2	3	4	5	6	7	8	9	10
C	**C**	**C**	**C**	**D**	**D**	**C**	**B**	**C**	**C**
11	12	13	14	15	16	17	18	19	20
A	**C**	**B**	**D**	**B**	**A**	**D**	**B**	**D**	**A**
21	22	23	24	25	26	27	28	29	30
C	**B**	**B**	**A**	**B**	**B**	**C**	**B**	**B**	**B**
31	32	33	34	35	36	37	38	39	40
C	**D**	**D**	**B**	**C**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

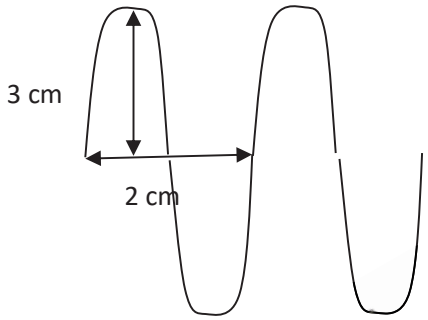
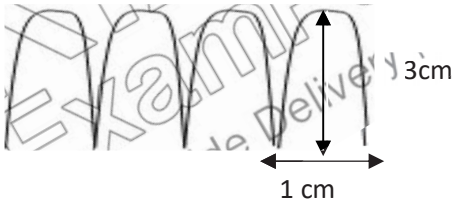
2019 Physics Prelim Paper 2

Qn	**Answer**
1(a)	The attachment is to provide the crane with better stability / make the crane more stable. It increases the base area of the crane OR it lowers the centre of gravity of the crane.
1(b)	Scale: 1 cm rep 10 kN Accurate drawing of vector diagram (incl. correct labelling of forces and direction of arrows):  Tension of the cable = 56 kN (accept 55 kN to 57 kN)
2(a)(i)	Q = mcΔT = (22/1000) x 2100 x 12.0 = 554.4 J = 550 J (2 sf)
2(a)(ii)	Q = ml = (22/1000) x 3.3 x 10^5 = 7260 J = 7300 J (2 sf)
2(b)(i)	Q = mcΔT 554.4 + 7260 + (22/1000 x 4200 x 8.0) = m x 4200 x (22.0 – 8.0) *the mark is for showing the concept of heat lost = heat gained m = 0.15 kg (2 sf)
2(b)(ii)	No heat gain from the surroundings

Qn	Answer
3(a)	The resistance of the LDR increases as the light intensity decreases. The potential difference across LDR increases.
3(b)	V across fixed resistor = 2000 x 0.004 = 8.0 V $V_{output} = R_{output} / R_{total} \times V_{total}$ 8.0 V = 2000 / (R_{LDR} + 2000) x 12 V R_{LDR} = 1000 Ω **OR** V = IR 12 – 8 = (4/1000) x R R = 1000 Ω
3(c)(i)	Effective R = $(1/4000 + 1/3000)^{-1}$ = 1700 Ω (2s.f)
3(c)(ii)	The total resistance in the branch with point P is higher than that with point Q. Since potential difference across each branch is constant, current flowing through point P is lower than current flowing through point Q.
4(a)	Electrical energy → Heat
4(b)	The external surface of the tea kettle could be modified to one with a shiny silver surface which is a poor emitter of infrared radiation to the surroundings, so as to minimize heat lost to surroundings.
4(c)	Energy = Power x Time = 2.8 kW x 10/60 x 7 h = 3.27 kWh Cost = 3.27 kWh x $0.18 x 1.03 = $0.61
4(d)	I = P / V = 2800 / 230 = 12.2 A Suitable fuse rating = 13 A
5(a)	The paint droplets repel each other as they have the same charge / same charges repel.
5(b)	The positively charged paint droplets induced a negative charge on the surface of the metal panel. As opposite charges attract, most of the paint droplets are attracted to the metal panel, reducing the amount of paint loss.

Qn	Answer
5(c)	The paint droplets are charged by friction. The paint droplets lose electrons to the nozzle as they leave the nozzle.
6(a)(i)	The long spring can be given a displacement such that the movement of each turn on the long spring is parallel to the direction of the wave motion set up.
6(a)(ii)	
6(b)(i)	Wavelength = 6 cm v = fλ = 5.0 x 6 = 30 cm/s
6(b)(ii)	1. frequency – remains unchanged as source of wave is the same 2. wavelength – becomes smaller as speed decreases in the shallow region
7(a)	Different colours of light travel at the same speed in air. However, different colours of light travel at different speeds in diamond. Therefore, there are different angles of refraction for different colours / different colours bend at different angles. OR There are different refractive indices for different colours, hence white light disperses into its various rays.
7(b)(i)	$n = \frac{sin49°}{sin18°}$ n = 2.4 (2 sf)
7(b)(ii)	v = 3 x 10^8 / ($\frac{sin49°}{sin18°}$) = 1.2 x 10^8 m/s (2 s.f.)
7(c)	Blue light would bend towards the normal less at the water-diamond boundary as compared to the air-diamond boundary. This is due to the higher refractive index of water compared to that of air.

Qn	Answer
8(a)	first metal bar [ ] [ ] second metal bar [ ] third metal bar Bring one end of the first metal bar near to both ends of the second metal bar, and then to both ends of the third metal bar. The repulsion between two metal bars will enable the student to identify them as the two magnets.
8(b)	Steel
8(c)(i)	Magnetic field can be investigated by placing a plotting compass on the piece of card and marking the positions of the needle of the compass. OR Use iron filings to investigate the pattern of magnetic field lines.
8(c)(ii)	 • The inner circles are closer to each other • Correct direction
9(a)	In the first second, the train travels at a constant speed of 8.3 m/s. In the next two seconds, the train accelerates uniformly.
9(b)(i)	Average acceleration = (v – u) / t = (41.5 – 8.3) / (3.0 – 1.0) = 16.6 m/s^2 (3 sf) Tension = m x a = 1800 x 16.6 = 29 880 N = 29 900 N (3 sf)

Qn	Answer
9(b)(ii)	The actual average tension is higher than the answer in (b)(i) as there is friction between the moving parts and air resistance in actual situation.
9(c)	Total distance travelled = (8.3 x 1) + ½ (8.3 + 41.5)(3-1) = 58.1 m
9(d)	The claim is false. The total mass is not halved as the mass of the empty train remains constant. Thus, the acceleration will not be doubled.
10(a)(i)	
10(a)(ii)	When the coil rotates, it cuts the magnetic flux which induces an emf across the two ends of the coil. When the coil changes position after half a revolution, the emf induced is reversed. When the coil is horizontal, emf induced is maximum, when the coil is vertical, emf induced is zero.
10(a)(iii)	
10(b)(i)	When the strings are plucked, their relative distances with the coil change (vibration), and the magnetic flux linking the coil changes as a result. The vibration thus causes an e.m.f. to be induced in the coil. Hence an induced emf in the coil means a detection of the vibration in the string.
10(b)(ii)	The changing induced current in the coil that causes the force/ vibration/ movement of coil in loudspeaker [Fleming's Left-hand Rule] is in sync with the variation of current. The vibration of coil will cause the cone in the loudspeaker and hence the air around it to vibrate and produces sound. (produces regions of compressions and rarefactions in the layer of air next to it)

Qn	Answer
11 EITHER	
11(a)(i)	Anti-clockwise direction from the front
11(a)(ii)	When current flows into the coil through the magnetic field of the magnet, it results in a force produced such that the coil will turn. The split-ring commutator reverses the current in the coil every half a cycle so that the coil can turn continuously in one direction.
11(b)(i)	When switch S is closed, the soft iron core becomes magnetised and attracts the soft iron spring attached to the hammer. The hammer strikes the metal plate and produces the first sound note. When the swtich is released, the circuit is broken and iron core loses magnetism and hammer swings to the other metal plate, producing the second sound note.
11(b)(ii)	Yes, the iron core will be magnetized and the spring will be attracted similarly, although there is a change of polarity.
11(b)(iii)	1. Increase the current flowing through the wire 2. Increase the number of turns around the soft iron core
11 OR	
11(a)(i)	Pressure is the force acting (on an object) per unit area.
11(a)(ii)	Pressure due to sea-water at depth 30 m = hρg =1100 x 10 x 30 = 330 kPa
11(a)(iii)	Total pressure = 330 k + 100 k = 430 k Pa Force = pressure x area = 430 000 x 0.50 = 215 kN
11(a)(iv)	The volume decreases so that the pressure of the trapped air becomes the same as the pressure at 30 m / there is higher pressure exerted.
11(b)	The density of the sea water in that region is lower resulting in lower pressure at depth of 30 m. Hence the volume of the trapped air increases to give a lower pressure that balances the external pressure.
11(c)	When temperature increases, the air molecules gain kinetic energy and have greater speed / average KE of molecules increases. The molecules will collide with the wall more often and hence increasing the force acting on the wall. Since pressure is due to the force acting on the wall per unit area, larger force acting on the wall results in a larger pressure (P = F/A).