

Answer Key

2019 Prelim Examination

Sec 4 Express

Physics

Paper 1

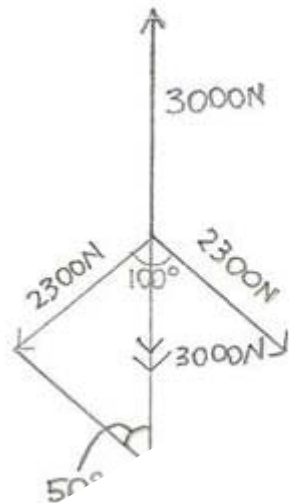
1	B	11	A	21	C	31	D
2	B	12	D	22	D	32	B
3	C	13	C	23	B	33	D
4	B	14	D	24	B	34	B
5	B	15	C	25	A	35	B
6	B	16	B	26	C	36	B
7	D	17	D	27	D	37	D
8	D	18	C	28	B	38	D
9	D	19	B	29	D	39	D
10	A	20	C	30	B	40	B

Answer Key

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 Paper 2

Section A

1 (a)



- [1] for scale (1 cm : 1000 N)
- [1] for correct drawing of forces
- [1] for correct labelling
- [1] Tension – accept 2200 N to 2400 N

(b) $W = mg$
 $3000 = m \times 10$ [1]
 $m = 300 \text{ kg}$ [1]

2 (a) Total distance = area under speed-time graph
 $= 0.5 \times (7+4) \times 80 / 60$
 $= 7.333 \text{ km}$ [1]
 average speed = $7.333 / (7/60)$
 $= 62.9 \text{ km/h}$ [1]

(b) $a = (v - u)/t$
 $= (0 - 80) / (2/60)$ [1]
 $= -2400 \text{ km/h}^2$

Deceleration = 2400 km/h^2 [1]

(c) Weight and [1]
 normal reaction force / contact force [1]

3 (a) $\eta = \frac{\sin i}{\sin r}$
 $= \frac{\sin 50^\circ}{\sin 30.8^\circ}$ [1]

$= 1.50$ (3sf) [1]

(b) $\eta = \frac{1}{\sin c}$
 $\sin c = \frac{1}{1.50}$ [1]

$c = 41.8^\circ$ (3sf) [1]

(c) Total internal reflection will take place at point Y. [1]

Angle of incidence at point Y = $180^\circ - 90^\circ - 30.8^\circ = 59.2^\circ$

Explanation: angle of incidence at point Y is greater than the critical angle [1]

4 (a) correct order of powers of ten [1]
 correct order of spectrum [2]
 (exchanging two parts or moving one part produces correct order [1])

short wavelength							long wavelength
gamma rays	X-rays	ultraviolet	visible	infra-red	microwaves	radio waves	
10^{-14} m	10^{-10} m	10^{-8} m	10^{-6} m	10^{-5} m	10^{-2} m	10^3 m	

(b) 3×10^8 m/s [1]

(c) any TWO from cooking, intruder (accept burglar, motion, security) [2]
 alarms,
 any **specific** sensor or medical use, remote controls, night vision,
 heating (e.g. just heating or heating a greenhouse, heating a solar panel),
 detect temp., see in fog,
 detect hot bodies, IR astronomy, distance measurement

- 5 (a) Excess electrons from the negatively charged Van de Graaff generator flows to the student, causing his whole body to be negatively charged. [1]
As his hair strands attain a negative charge, they are repelled from the body as like charges repel, thus making the hair stand on ends. [1]
- (b) (i) $V = W / Q$
 $15,000 = 0.3 / Q$ [1]
 $Q = 2 \times 10^{-5} \text{ C}$ [1]
- (ii) Current [1]
- 6 (a) (i) When current is flowing in the coil, it generates a magnetic field in and around the coil.
Hence the recording head is magnetised as an electromagnet, which in turn magnetises the tape. [1]
- (ii) magnetism / magnetic field or current or poles on head reverses / changes direction [1]
- (iii) each direction / one cycle longer (on tape) [1]
- (b) (i) need to keep record / tape stored [1]
- (ii) steel etc. [1]
- 7 (a) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$
 $= \frac{1}{6} + \frac{1}{3}$ [1]
 $R = 2 \Omega$ [1]
- (b) $V = IR$
 $12 = 2 \times R$
Total $R = 6 \Omega$ [1]
Resistance of lamp = $6 - 2 = 4 \Omega$ [1]
- (c) $E = Pt = I^2 R \times t$
 $= 2^2 \times 4 \times (2 \times 60)$ [1]
 $= 1920 \text{ J}$ [1]

- 8 (a) (i) meter deflects one way then returns to zero [1]
 (current in left coil creates a) magnetic field [1]
 magnetic field / flux cuts right-hand coil or changes (and induces a voltage) [1]
 meter returns to zero because no more change in flux [1]
- (ii) meter remains at / returns to zero **and** no change in flux / no flux cuts coil [1]
- (iii) meter deflects in opposite direction [1]
 field change in opposite direction **or** field / flux cuts in opposite direction [1]
- (b) direction of current / magnetic field constantly **changes** [1]
- (c) inserting a soft iron core into the coil any
 increasing the number of turns in the coil two
 increasing the current in the coil [2]

Section B

- 9 (a) $KE = \frac{1}{2} mv^2$
 $= 0.5 \times 0.025 \times 56^2$ [1]
 $= 39.2 \text{ J}$ [1]
- (b) $a = (v-u)/t$
 $\cong (0 - 56)/0.02$ [1]
 $= -2800 \text{ m/s}^2$
 Deceleration = 2800 m/s^2 [1]
- $F = ma$
 $= 0.025 \times 2800$ [1]
 $= 70 \text{ N}$ [1]
- (c) work done = $F \times d$
 $= 70 \times 0.12$ [1]
 $= 8.4 \text{ J}$ [1]
- (d) By the Principle of Conservation of Energy
 $KE = W + \text{GPE}$
 $39.2 = 8.4 + \text{GPE}$ [1]
 $\text{GPE} = 30.8 \text{ J} = mgh$
 $h = (30.8) / (0.025 \times 8.0)(10)$
 $= 0.384 \text{ m (theoretical value)}$ [1]

- 10 (a) (i) The polystyrene foam which traps air is a good heat insulator. [1]
It is a good insulator and it prevents heat conduction. [1]
- (ii) The cooling unit cools the air at the top. [1]
As the cool air contracts and sinks, the warm air rises. [1]
This movement of air sets up a convection current. [1]
This convection current cools all the contents of the refrigerator. [1]
- (iii) Shiny and smooth surfaces are poorer emitters compared to black and dull surfaces. [1]
Hence only a small amount of energy is radiated by the inside wall. [1]
- (b) (i) $E = mc\Delta\theta$
 $= 100 \times 4.2 \times (50 - 46)$ [1]
 $= 1680 \text{ J}$ [1]
- (ii) $E = mc\Delta\theta$
 $= 3.0 \times 4.2 \times (46 - 0)$
 $= 580 \text{ J (3sf)}$ [1]
- (iii) Latent heat required = $1680 - 580$
 $= 1100 \text{ J}$ [1]
- (iv) specific latent heat of fusion $l_f = L_f / m$
 $= 1100 / 3.0$
 $= 367 \text{ J/g}$ [1]

EITHER

- 11 (a) The Principle of Moments states that when a body is in equilibrium, the sum of the clockwise moments about a pivot is equal to the sum of the anticlockwise moments about the same pivot. [1]
[1]
- (b) The moment of a force is the product of the force and the perpendicular distance from the pivot to the line of action of the force. [1]
SI unit: Nm [1]
- (c) (i) Weight of each piece $W = m \times g$
 $= 5 \times 10$
 $= 50 \text{ N}$ [1]
No. of weights at C = $250 / 50$
 $= 5$ [1]

- (ii) moment = $F \times d$
 $= 250 \times 0.2$ [1]
 $= 50 \text{ Nm}$ [1]
- (iii) By the Principle of Moments
sum of clockwise moments = sum of the anticlockwise moments
 $50 = F \times 0.25$ [1]
 $F = 200 \text{ N}$ [1]

OR

- 11 (a) (i) Live conductors allow current to flow through and reach the appliance. [1]
- (ii) Neutral conductors allow the current to flow back to the source and hence complete the circuit. [1]
- (b) (i) The fuse rating is much higher than the amount of current flowing through the circuit. [1]
When excessive current flows through the appliance, the fuse may not melt and disconnect the circuit. As a result, it may cause harm to the user or damage to the appliance. [1]
- (ii) The metal case becomes live when the live wire is damaged and touches the metal case. [1]
As a result it may cause harm to the user or damage to the appliance. [1]
- (c) The circuit breaker works faster in disconnecting all the switches in the house. Any one
The circuit breaker only needs to be reset after activated whereas the fuse needs to be replaced after melting. [1]
- (d) Wire X: Live [1]
Wire Y: Neutral [1]
Wire Z: Earth [1]

