SAJC JC2 H1 Physics Prelims 2024 Paper 1 Solutions

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	A	C	D	C	B	D	B	D	C
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
D	A	C	A	A	D	B	C	B	B
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	B	C	A	B	C	B	C	D	D

1 **Ans: C**

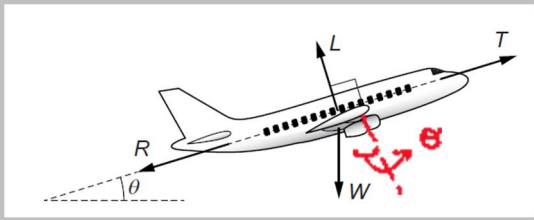
Wire diameter H 0.1 cm (can estimate by using your ruler thus estimate in cm)
Area H □r^2 = □ $(0.05/100)^2$ = 7.8 x 10^{-7} m^2

2 **Ans: A**

Charge. Current not charge is the SI base quality for electricity quantities.

3 **Ans: C**

Since the plane is moving at constant speed, a = 0 □ F_{net} = 0



Along the path, W sin⟨ + R = T
Perpendicular to path, W cos⟨ = L

4 **Ans: D**

Average value = 48.00 mm is far from the true diameter of 42.03 mm thus it is NOT ACCURATE

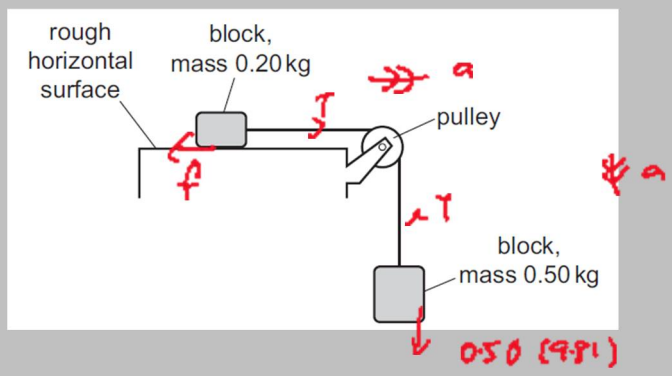
The set of repeated readings are close to each other thus PRECISE.

5 **Ans: C**

$s = ut + ½ at^2$
$s = ½ (9.81)T_E^{\ 2}$ --- (1)
$s = ½ (3.71)T_M^{\ 2}$ --- (2)
(2) / (1): $T_M / T_E = (9.81/3.71)^{1/2}$ = 1.63

6	**Ans: B** acc = gradient of v-t graph Initially, gradient is positive and decrease to zero. Then gradient is negative, much steeper than the positive gradient and then become zero. C, D – incorrect as initial acceleration should be positive A – incorrect as the negative acceleration is not bigger than the positive acceleration
7	**Ans D** The force the Earth acts on sky-diver is equal to the force the sky-diver acts on Earth as they are action-reaction pair but they will not cancel each other as they are not acting on the same body.
8	**Ans: B** X: Air resistance increases with velocity till a constant value Y: F_{net} = weight – air resistance decreases till zero as weight = constant
9	**Ans: D** For m, $KE_f = ¼\ KE_i$ $½\ m\ v_m^2 = ¼\ (½\ mu^2)$ $v_m = u / 2$ By COM, $mu = m\ (- u /2) + 4mv_{4m}$ $3u / 8 = v_{4m}$
10	**Ans: C** Since p_i is not zero as the momenta of the spheres are not equal, $p_{2kg} = 4x\ 2$ $p_{3kg} = 6 \times 3$ thus by COM, p_f 0 as $p_f = p_i$ A – Impulse $F \otimes t = \otimes p$ is equal and opp when COM can be applied as $F_{net} = 0$ (N3L) B, D – momentum not mass or speed is considered in COM
11	**Ans: D** Torque of a couple = 15sin 65° (0.4) = 5.4 Nm

12 **Ans: A**



For 0.50 kg, 0.50(9.81) – T = 0.50 (2.0)
T = 3.9

For 0.20 kg, T – f = 0.20(2.0)
f = 3.9 – 0.4 = 3.5 N

13 **Ans: C**

Horizontally, F = ⊗p/⊗t =(200/1000) [7 – (-14)]/0.6 = 7.0 N

14 **Ans: A**

Initially,
F = kx for each wire
1/3 W = kx (Weight of lamp W is shared equally by the 3 wires)
W = 3kx

Finally,
½ W = kx' (W is now shared equally by the 2 wires)
½ (3 kx) = kx'
x ' = 3/2 x

difference between h = x' – x = 3/2 x – x = 0.5 x = 0.5 (0.4 cm) = 0.20 cm

15 **Ans: A**

Since the car is travelling at constant speed, friction f =driving force F

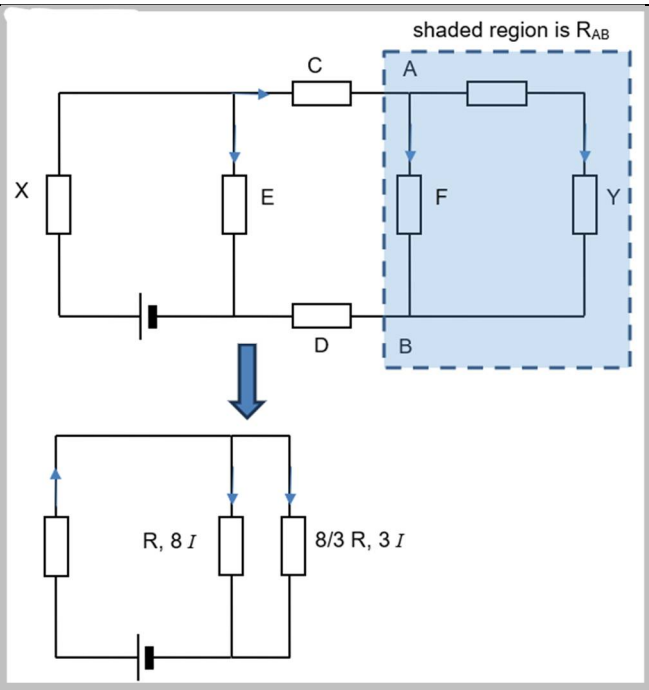
P = Fv = fv
Pt = fvt
E = fvt

Since f□v^2 and t = d/v
E□v^2

E_{60km}/ E = $(60)^2/(70)^2$
E_{60km} = 0.73 E

16 **Ans: D**

	$W = Fd = P + K$ $4W = 4Fd = 4\ (P + K) = 4\ P + 4\ K$
17	**Ans: B** Forces acting on the ball is weight and tension. Do not draw F_{net} which is the centripetal force in a FBD
18	**Ans: C** A minute hand takes 1 hr to cover 2□ $\omega = 2\pi / T = 2\pi / 3600 = 1.7 \times 10^{-3}$ rad s^{-1}
19	**Ans: B** $a = r\omega^2 = r\ (2\pi/T)^2$ $(a/r)^{1/2} = 2\pi/T$ $T = 2\pi\ (r/a)^{1/2}$ $12T = 24\pi(r/a)^{1/2}$
20	**Ans: B** $V = WD / Q$
21	**Ans: B** $P_x = I^2R = 9R$ $1.5\ P_x = 13.5\ R = I'^2R$ $I' = (13.5)^{1/2} = 3.7$ A
22	**Ans: B** If current in Y is *I*, then current in F is 2*I*, so current in C is 3*I* Let the resistance of one resistor be R, $R_{AB} = (1/1+1/2)^{-1}\ R = 2/3\ R$, so $R_{C + AB + D} = 1 + 2/3 + 1 = 8/3\ R$ Since current in $R_{C + AB + D}$ is 3*I*, then current in E is 8*I* so current in X = 3*I* + 8*I* = 11*I*



23 **Ans: C**

E = Ir + V
V = E – Ir
V = 3.0 – 0.50I

Y -intercept = 3.0
Gradient = 0.50 = 3.0 / x- intercept
x -intercept = 3.0 / 0.50 = 6.0

24 **Ans: A**

Current increases means the overall resistance of the circuit decreases R_T decreases temperature increases

V_T = 12 – 40(0.10) = 8 V
V_T‘ = 12 – 40(0.12) = 7.2 V

R = V/I = 7.2 / 0.12 = 60 ∧

or

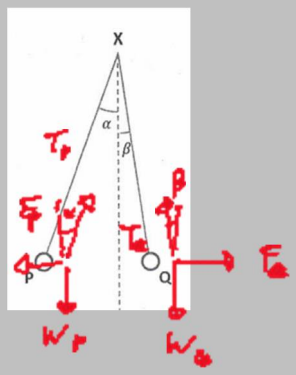
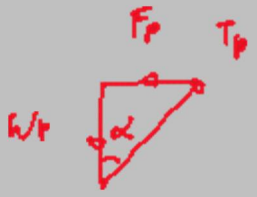
I = ∑ / (R_T + 40)
0.12 = 12/ (R_T + 40)
R_T = 60 ∧

25 **Ans: B**

When ⍳ = 0°, I is perpendicular to B thus F = BIL = max

As ⍳ increases, F = BIL cos⍳

 A cosine graph starting with max F at ⍳ = 0°

26	**Ans: C** When a current flows in the wire from A to B, using RHGR, the B-field due to the current is vertically downwards at position of the compass. Since the B-field due to the current is much larger than B-field due to Earth, a possible resultant B-field is vertically downwards.
27	**Ans: B**   $\tan \theta = F_p / W_p$ $\tan \theta = F_Q / W_Q$ Since $\theta > \theta$ $\tan\theta > \tan\theta$ $F_p / W_p > F_Q / W_Q$ (Since $F_P = F_Q$) $W_p < W_Q$ $m_p < m_Q$
28	**Ans: C** Energy released in 1 reaction $= \otimes m\ c^2$ $= (2.014102 + 3.016049 – 4.002602 – 1.008665)\ x1.66 \times 10^{-27} \times (3 \times 10^8)^2$ $= 2.821 \times 10^{-12}$ J Energy used per month = 2000 kWh = $(2000 \times 10^3 \times 3600)$ J No of reaction = Energy used per month/ Energy released in 1 reaction = 2.6×10^{21}
29	**Ans: D** A random process is defined as a process in which the exact time of decay of a nucleus cannot be predicted. Instead, the nucleus has a constant probability, ie. the same chance, of decaying in a given time. Therefore, with large numbers of nuclei, it is possible to statistically predict the behaviour of the entire group. One cannot know which nucleus will decay and when it will decay because it is down to chance.
30	**Ans: D**

	For paper, beta to be used as all alpha would be stopped and all gamma would penetrate For steel, gamma to be used as all alpha and beta would be stopped.