2024 Sec 4 Preliminary Examination Physics
Mark Scheme
Paper 1

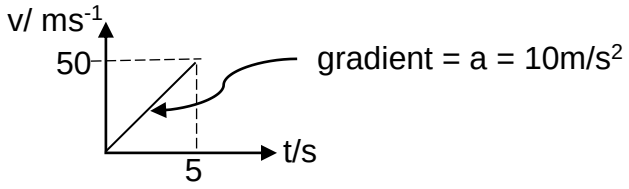
1	2	3	4	5	6	7	8	9	10
B	D	C	C	D	A	C	C	A	B
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
D	C	D	B	C	A	D	D	B	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A	B	C	C	D	C	B	B	B	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
C	B	B	D	B	D	B	B	A	C

1 B
Weight of normal sized apple is 70 – 100g

2 D
$1.8\ g/cm^3 = 1.8 \times 10^6\ g / m^3 = 1800\ kg / m^3$

3 C
R is not always smaller or greater than P or Q.
R, which is the vector sum of P and Q, cannot be in the same direction as P or Q, given that angle between P and Q is 30^o to 150^o

4 C



displacement = ½ x 5 x 50 = 125 m

5 D
Velocity stops increasing and acceleration is zero when air resistance is equal to weight of object

6 A

7 C
90 – 60 = (6) x (a)
$a = 5m/s^2$
P: $T_1 – 10 = (1) \times (5)$
$T_1 = 15\ N$
Q: $T_2 – T_1 – 20 = (2) \times (5)$
$T_2 = 45\ N$

8 C
Initial overall CG should be higher than X. When volume of sand increases, overall CG should move upwards (since there is now more sand at the higher levels). Since CG rises, stability decreases.

9 A
ACW = CW
0.57 X 10 X 10 = (0.5 X 30) + (F_N X 50)
50 F_N = 42
F_N = 0.84 N

10 B

11 D
$P_{gas} – P_{atm}$ = hρg = 520 Pa

12 C
Force F is not equal to weight of load.
Pressure throughout the liquid is the same according to Pascal principal

13 D
Since same speed, KE remains the same
Chemical potential store from muscles convert to gravitational potential store

14 B
Output power = mgh/20 = 0.6 x 300 W = 180 W
W = mg = (180 x 20) / 6 = 600 N

15 C
The bends represent the change in direction of the illuminated smoke particles when they are hit by the air molecules from all directions with different magnitude. This shows that air molecules are in continuous random motion

16 A
Less air molecules left in the packet colliding with a smaller surface area. Pressure inside the packet decreases and packet shrinks.

17 D
Black surface are better absorbers of energy through heating and shiny surface are better reflectors / retainers of energy through heating.

18 D
gold: Q = mcΔθ_1
copper: Q = 2m x 3c x Δθ_2
mcΔθ_1 = 6 mc Δθ_2
Δθ_1 = 60 ^oC

19 B
When latent heat is lost, molten wax changes from liquid to solid.

20 B
Evaporation causes cooling when the most energetic molecules leave the water.

21 A
Heat cannot be conducted quickly via water to reach the ice.

22 B
(uses of different types of EM waves)

23 C
$n_x = \sin 50^o / \sin 40^o$
$n_y = \sin 40^o / \sin 50^o$
$n_z = \sin 50^o / \sin 30^o$

$n_z > n_x$

24 C
$n = c/ v = (3 \times 10^8) / (1.8 \times 10^8) = 1.67$
$n = 1/ \sin c$
$1.67 = 1/ \sin c$
$c = 37^o$

25 D
Frequency of ultrasound is beyond human audible range.

26 C
Gamma rays has higher frequency than X-rays. Taking frequency to be 3.0×10^{20}, $\lambda = 3.0 \times 10^8 / 3.0 \times 10^{20} = 1.0 \times 10^{-12}$ m

27 B
Period decreases as shown from the graph.
$f = 1 / T$
therefore frequency increases.

28 B
Negative charges are induced to the side of sphere X near to the charged rod and the far side in sphere Z with a deficit of negative charges will be positively charged.

29 B
Rod gains electrons and becomes negatively charged. Cloth loses electrons and becomes positively charged

30 C
$W = QV$

31 C
$R_Q = R/2$, $R_P = R$
$I_P = 1/3\ I$

32 B
$I_2 = 3\ I_1$
$R_2 = R_1 / 3$
$R_1 = 2R + X$

33 B

When light intensity increases, R_{LDR} decreases.
By potential divider rule, V_{LDR} decreases too. Since overall resistance decreases, current and thus ammeter reading increases.

34 D

To demagnetize the magnet, there must be a strong enough changing magnetic field to misalign / de-orientate the magnetic dipoles.
Option D is better than option B because a changing magnetic field is more effective in de-orientating the magnetic dipoles than a constant magnetic field, assuming the strength of the magnetic field is the same.

35 B

Using FLHR. Current is opposite direction to electrons flow.

36 D

By lenz's law, induced current will flow in such a way to produce a north-pole at Q and a south-pole at P.
When the south-pole is pushed into end P, according to Lenz's law, the induced current will flow in the same way as above to produce a south-pole at P.

37 B

Answer can only be A or B since voltage is stepped down.
Based on 240 V and 180 V, the turn ratio is 4:3. Conversely, current is stepped up by inverse of the turn ratio 3:4.

38 B

Since 1/8 of the radioactive sample is left, the sample underwent 3 half lives, $(1/2)^3$. Half life is therefore 4 days.
In 24 days, sample underwent 6 half lives, $(1/2)^6 = 1/64$.

39 A

The resulting nuclide has one more proton and thus one less neutron.

40 C

Characteristics of alpha, beta and gamma radiation