2019 Y4 Phy FE Mark Scheme (MARKERS TO UPDATE MARKS/ANSWER/COMMENTS)

Section A Multiple Choice Questions

Qn	Ans	Qn	Ans	Qn	Ans
1	C	**11**	A	**21**	B
2	C	**12**	A	**22**	C
3	C	**13**	D	**23**	A
4	D	**14**	C	**24**	B
5	B	**15**	C	**25**	D
6	B	**16**	B	**26**	C
7	D	**17**	B	**27**	A
8	A	**18**	C	**28**	A
9	D	**19**	A	**29**	B
10	D	**20**	B	**30**	B

Section B Structured Questions

31 From $R = 6\pi\eta rv$,

$$\eta = \frac{R}{6\pi rv}$$

Unit of $\eta = \dfrac{\text{kg.m s}^{-2}}{\text{m.m s}^{-1}}$ (correct units for each quantity)

$= \text{kg.m}^{-1}\text{.s}^{-1}$

32 **(a)** Acceleration is constant.
Motion is along a (straight) line or all vectors are along a line.

(b) **(i)** $s_{bag} = u_{bag}\, t + \frac{1}{2}\, a_{bag}\, t^2 = (-10.0)(4.00) + \frac{1}{2}\,(9.81)(4.00)^2 = 38.5$ m

Note: allow both $\pm$ answers

(ii) $s_{balloon} = u_{balloon}\, t + \frac{1}{2}\, a_{balloon}\, t^2 = (10.0)(4.00) + 0 = 40.0$ m

Separation between balloon and the sand bag = 40.0 + 38.5 = 78.5 m

(c) **(i)** Magnitude = $\sqrt{(3.0^2 + 10.0^2)} = 10.4$ m s^{-1}

Angle = $\tan^{-1}(10.0/3.0) = 73.3°$ above the 3.0 m s^{-1} velocity vector.
(Reject angle w/o reference line, and reject reference to NSEW/bearings.)

Note: As question states "calculate", max [1] for scale drawing.

(ii) Both sand-bags take the same time to reach the ground (because the horizontal wind has no effect on the vertical motion).

33 **(a)** Taking moments about support A, since the rod is not rotating,

anti-clockwise moments = clockwise moments
$F_B \times 7.00 = 4.00 \times 5.00$
$F_B = 20.0/7.00 = 2.86$ N (3 sf)

(b) From Newton's 2nd Law, since the rod is not moving, (reject other methods)
total upward forces = total downward forces
$F_A + F_B = W$
$F_A = 5.00 - 2.86$
= 2.14 N (allow ecf)

34 **(a)** loss in KE $= \frac{1}{2}mv_1^2 - \frac{1}{2}mv_2^2$
$= \frac{1}{2}(2.79 \times 10^5)(35.0^2 - 15.0^2)$
$= \mathbf{\underline{1.40 \times 10^8\ J}}$

(b) B [A1] – highest SHC, so <u>increase in temperature is minimised</u> [M1]
OR
C [A1] – lowest density, <u>so lightest</u> [M1]
D [A1] – highest melting point, so <u>least likely to melt</u> [M1]

(c) Initial acceleration -
Distance covered = 640 m, time taken = 32 s

Deceleration before region -
Distance covered = 724.375 m, time taken = 23.75 s

Travel at Constant speed in first region –
Distance covered = 1483.625 m, time taken = 37.1 s

Travel in second (safety) region –
Distance covered = 1.00 km, time taken = 47.6 s

Fastest speed in final region can only reach 36 m s^{-1} –
Distance covered during acceleration = 342 m
Time taken during acceleration = 12.0 s
Distance covered during deceleration = 810 m
Time taken during deceleration = 45.0 s

Shortest time = 197 s (3sf)

35 When a neutral body is placed closed to a positively charged body, <u>electrons will be attracted to the side facing the charged body</u>. The far side becomes positively charged.

The force of attraction is stronger than the force of repulsion.

Note: positive charges cannot move.

36 **(a)** $V_{out} = \frac{8000}{600+8000}\ x\ 12.0$

$= 11.2\ V$

(b) **(i)** 12.0 – 8.0 = 4.0V

(ii) Apply $R_1/R_2 = V_1/V_2$

Resistance = 4000 Ω

(c) Cooler, fan, aircon. (Reject fire alarm.)

The device will be switched on only when temperature is above 25 °C.

37 Output power of Kettle A = 2.8 x 0.70 = 1.96 kW
Output power of Kettle B = 3 x 0.60 = 1.80 kW

Choose Kettle A because the power output is larger.

38 Magnet is placed in a slenoid carrying alternating current.
Pull the magnet out slowly in the east west direction.

39 **(a)** Increase number of loops in the coil (w/o per unit length as stated in notes)
Increase magnetic field strength / bring magnets closer
Increase current /increase emf / reduce resistance
Insert soft iron core
Use longer/wider/bigger coil

B2 for 3 correct
B1 for 1 correct

(b) Coils is horizontal (max torque)
Left arm current out of paper AND right arm current into paper (clockwise)

40 **(a)** **(i)** North

(ii) Right (allow ecf)

(b) One wave with initial emf zero
Period labelled as 0.100 s
(ignore if more than 1 wave is drawn)

(c) **(i)** Both currents into paper. [B1 each]

(ii) There will be no induced current.

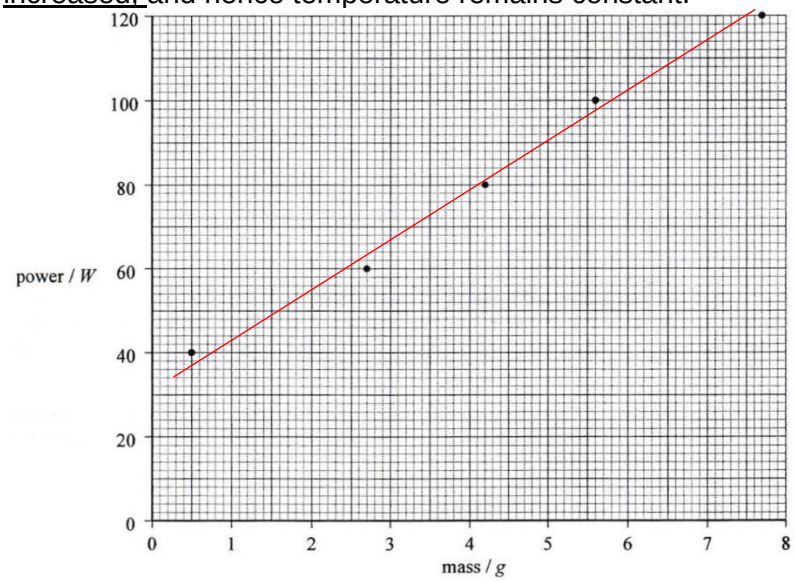
41 **(a)** **(i)** The specific latent heat of vaporization of a substance is the amount of thermal energy required to change a unit mass of the substance from liquid to gaseous state without a change in its temperature.

(ii) When the temperature of water remains constant at 100 °C / boiling point.

(iii) The thermal energy absorbed by water is used to weaken / overcome the intermolecular forces of attraction / break intermolecular bonds between the liquid particles OR Energy goes to change state of water, rather than change in temperature.

KE constant OR Only the internal potential energy of the particles is increased, and hence temperature remains constant.

(b) **(i)**



(ii) Gradient
= (80-50) / (4.00-1.50)
= 12 W / g (2 s.f.)

Note: accept 11-13 W/g and allow ecf

(c) L = power x time/mass = 12 W/g x 200 s
=2400 J / g

Note: allow ecf from (b)(ii)

(d) Energy is lost to the container/ surroundings.