Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a)

$\bar{u}s$	
$uu\bar{s}$	
$u\bar{s}$	✔
$\bar{d}\bar{d}s$	

only third box from top ticked
allow crosses in any other box

1

(b) (i) (lepton number of $K^+ = 0$)

lepton number of μ+ = −1 lepton number of $\nu_\mu = +1$ ✔

(hence lepton number zero before and after)

need to see

0 ⟶ −1 +1 ✔

(And 0 ⟶ 0)
Must be in correct order

1

(ii) Strangeness (number) ✔

allow <u>rest</u> mass
Not meson number

1

(iii)

	charged	hadron	meson	baryon	lepton
K^+	(✔)	✔	✔		
μ^+	(✔)				✔
ν_μ					✔

one mark for each correct row
ticks in correct boxes only

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allow crosses in other box(es)

3

(c) cannot be a lepton (to conserve lepton number) / cannot be a baryon (to conserve baryon number) / must be a meson

maximum of one mark for either of first marking point

cannot have a charge (to conserve charge) ✔

(must be) π^0 ✔

can be done by BLQ table for first two marks

TO on conservation wrong statements (−1 for each incorrect applied to the first two marking points)

allow K^0 as must be a meson

allowing strangeness to be conserved

3

[9]

Q2.

(a) pair production ✔

1

(b) (i) energy of photon needs to provide
at least the rest masses ✔

OR at least the rest energy ✔

of the electron and positron / of (both) particles / of particle and antiparticle ✔

Of the electron and positron / of (both) particles of particle and antiparticle ✔

Can't score 2nd mark without having scored 1st

(allow particles or products)
TO on any suggestion of particles have KE

2

(ii) minimum energy = 2 × 0.510999 = 1.021998 (MeV) ✔

must see working

***and** final answer must be at least 3 sf*

allow detailed argument in reverse
0.5 Mev close to 0.511 MeV

Or $E=mc^2$ leading to 1.024875 MeV

Or 2 × 5.5 × 10^{-4} × 931.5 = 1.02 MeV

1

(iii) (electron / positron have) kinetic energy ✔

thermal energy n/e

Momentum n/e

1

(iv) (attempts to convert energy to joules)
energy = 1.0 × 10^6 × 1.60 × 10^{-19} = 1.6 × 10^{-13} (J) ✔

Condone power 10 error on MeV

conversion to J

(use of $E = hf$)
Their energy ÷ 6.63 × 10^{-34} = f ✔

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Must see subject or their f on answer line consistent with working

$f = 2.4 \times 10^{20}$ ✔ cao

Hz (condone s^{-1}) ✔

Capital H and lower case z (for symbol)

Allow word written as Hertz (h lower case)

4

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