

FULL MARKS IF CORRECT.
(i.e. calculations don't need to be shown)

NOTE: don't double-deduct. 1. an error converting nm to m is not also automatically a calculation error!

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15

Q1. a) $E = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{(248.3 \times 10^{-9} \text{ m})} = 8.170160 \times 10^{-19} \text{ J}$

-2 if not changed to kJ/mol

-2 if not converted

-1 if converted wrong

-3 if divided by Avogadro's number

$(8.170160 \times 10^{-19} \text{ J})(6.02 \times 10^{23} \text{ /mol})$
 $(1 \times 10^3 \text{ J/kJ}) = 491.8436$
 $= 492 \text{ kJ/mol}$

-2 if multiplied by 1000

-2 calc error

-1 Rounding error

-1 sig figs

-2 units wrong or missing

b) $E_{\text{photon}} = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{(217 \times 10^{-9} \text{ m})} = 9.160368 \times 10^{-19} \text{ J}$

-2 if not converted to m.

(don't deduct again if conversion is wrong)

-7 if the value in part a is not SUBTRACTED FROM the value in b.

total E in : $9.160368 \times 10^{-19} \text{ J}$

- work function : $-8.170160 \times 10^{-19} \text{ J}$

"left over" energy: $0.990208 \times 10^{-19} \text{ J}$ of KE

-5 if one value

$= 9.9 \times 10^{-20} \text{ J}$

-2 calc. error

-1 sig figs

-2 wrong or missing units

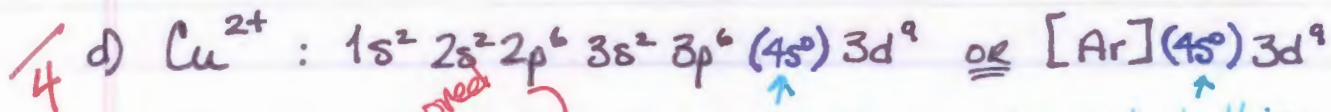
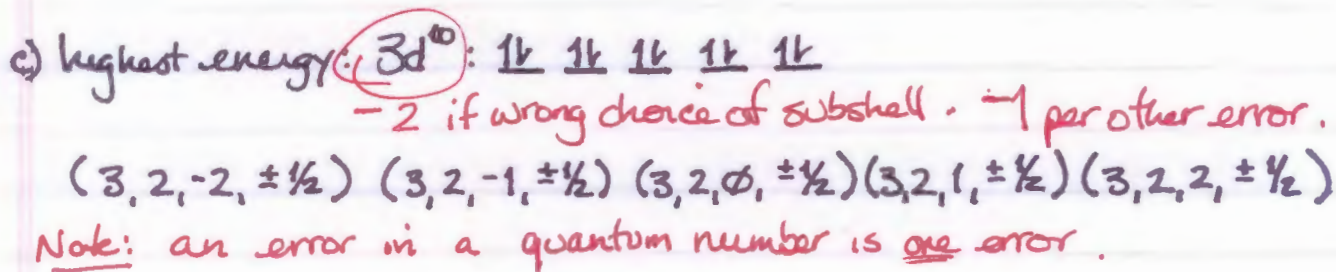
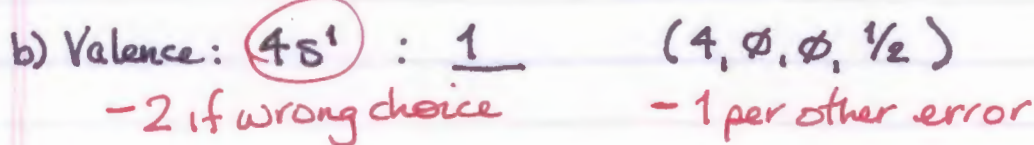
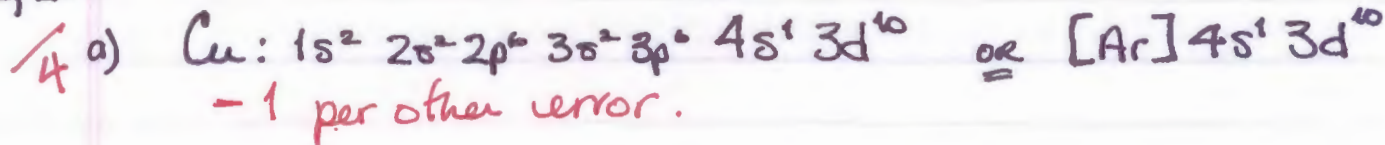
60. kJ/mol
 $(6.0 \times 10^1 \text{ kJ/mol})$
 -3 if given as E/mol

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-3 if given as $4s^2 3d^9$ in final answer.

Q2.



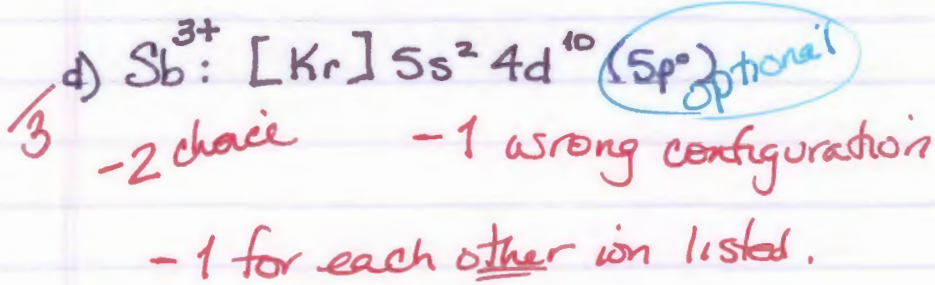
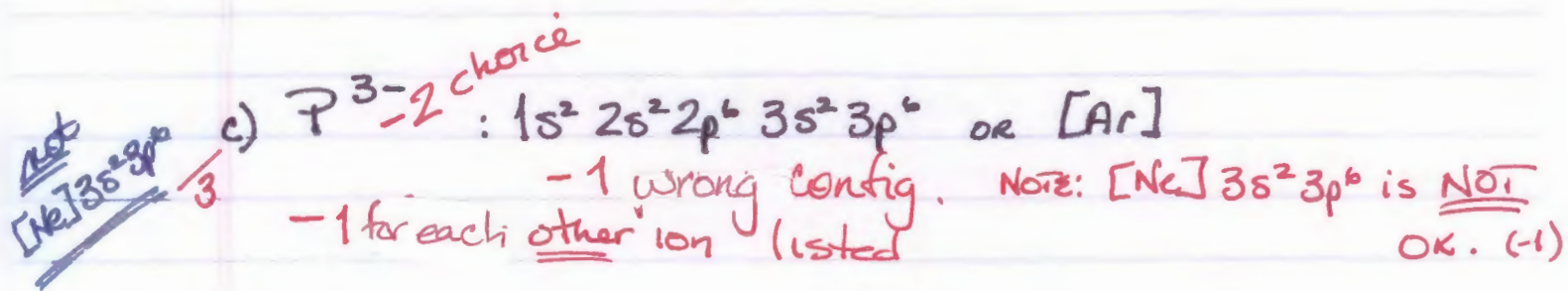
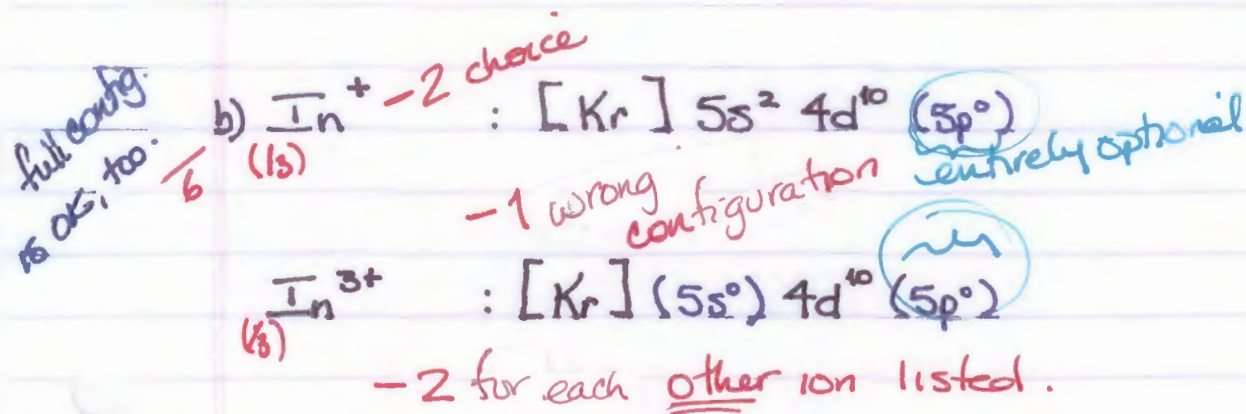
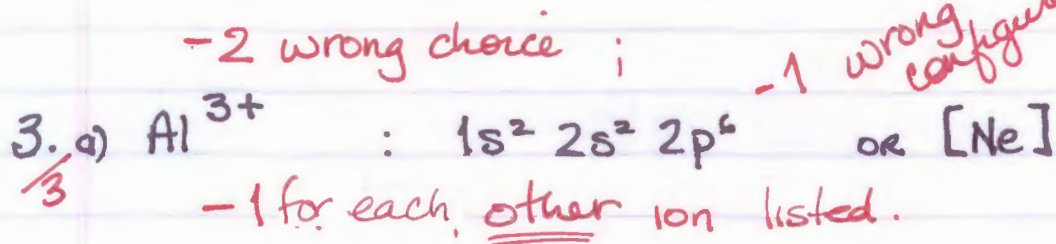
-3 if electrons not removed from the valence (the 4s)
 -1 per other error.

• Showing an empty subshell is entirely optional. Can be shown, shown in brackets, or left out entirely

FULL MARKS IF CONSISTENT
 with answer in part a.

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Note: Do not deduct more than the marks for that part of the question!

FULL MARKS IF CORRECT

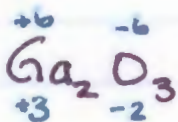
4.

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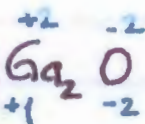
15 Q4

2 a)



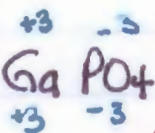
: Gallium oxide

2 b)



: Gallium (I) oxide

2 c)



: Gallium phosphate

* Do NOT deduct for capital letters or spelling as long as name is clear

3 d)



: Nitrogen monoxide
-1 if prefix

-2 if no prefix

-2 if any roman numeral

e) "Germanium": Ge^{4+} ; "Sulfate": SO_4^{2-} : $\text{Ge}(\text{SO}_4)_2$

2 f)

"Germanium": Ge^{4+} ; "sulfide": S^{2-} : GeS_2

2 g)

"Germanium(II)": Ge^{2+} ; nitrate: NO_3^\ominus : $\text{Ge}(\text{NO}_3)_2$

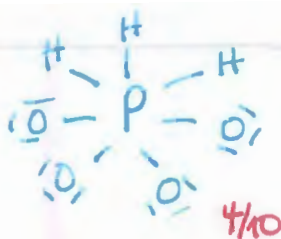
-1 if work shown and formula consistent with work
eg e) if Ge^{2+} & SO_4^{2-} shown, then $\text{GeSO}_4 \times \frac{1}{2}$

0 marks if wrong & no work shown.

NOTE one element wrong is SWIFELY WRONG!

- 1 each for:
 - roman numeral where none belongs
 - No roman numeral where one does belong
 - Wrong cation name
 - Wrong anion name.

NOTE:



any chain of elements:

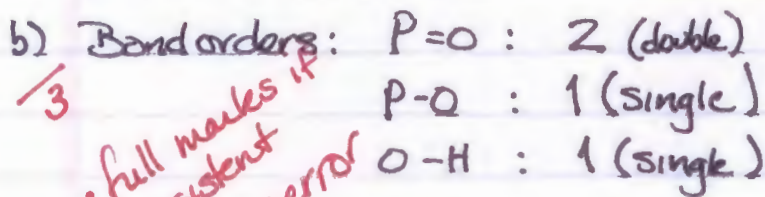
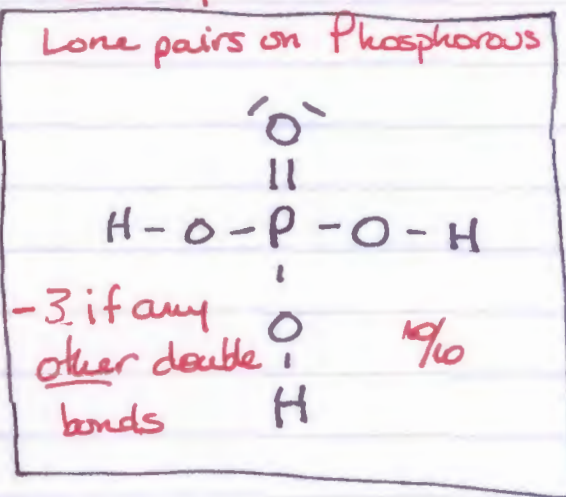
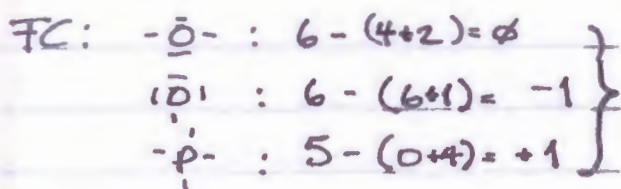
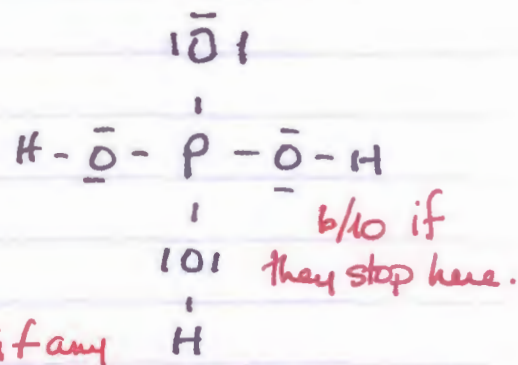
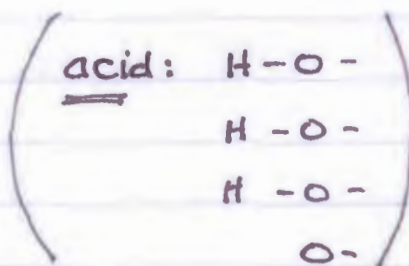
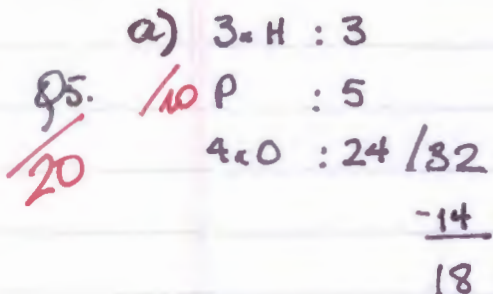
2/10 if correct number of electrons

5.

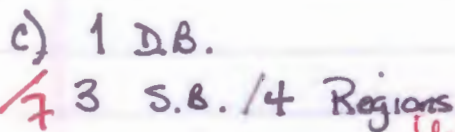
• if you can't see any pattern - give \emptyset & student can check with me.

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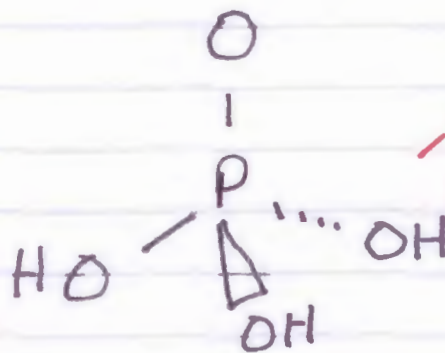


3
 • full marks if consistent
 - 2 per error

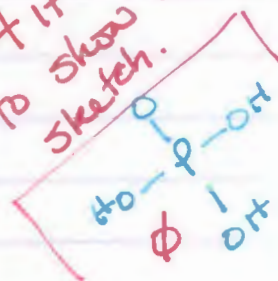


Not its OK if a student shows the bonds out to H atoms and/or the lone pairs on the O and/or the double bond.

full marks if consistent with their Lewis diagram
 • if you can't figure out their choice, give \emptyset & student can check with me.



-4 if no attempt to show 3-dimensional sketch.



Tetrahedral / 2: name

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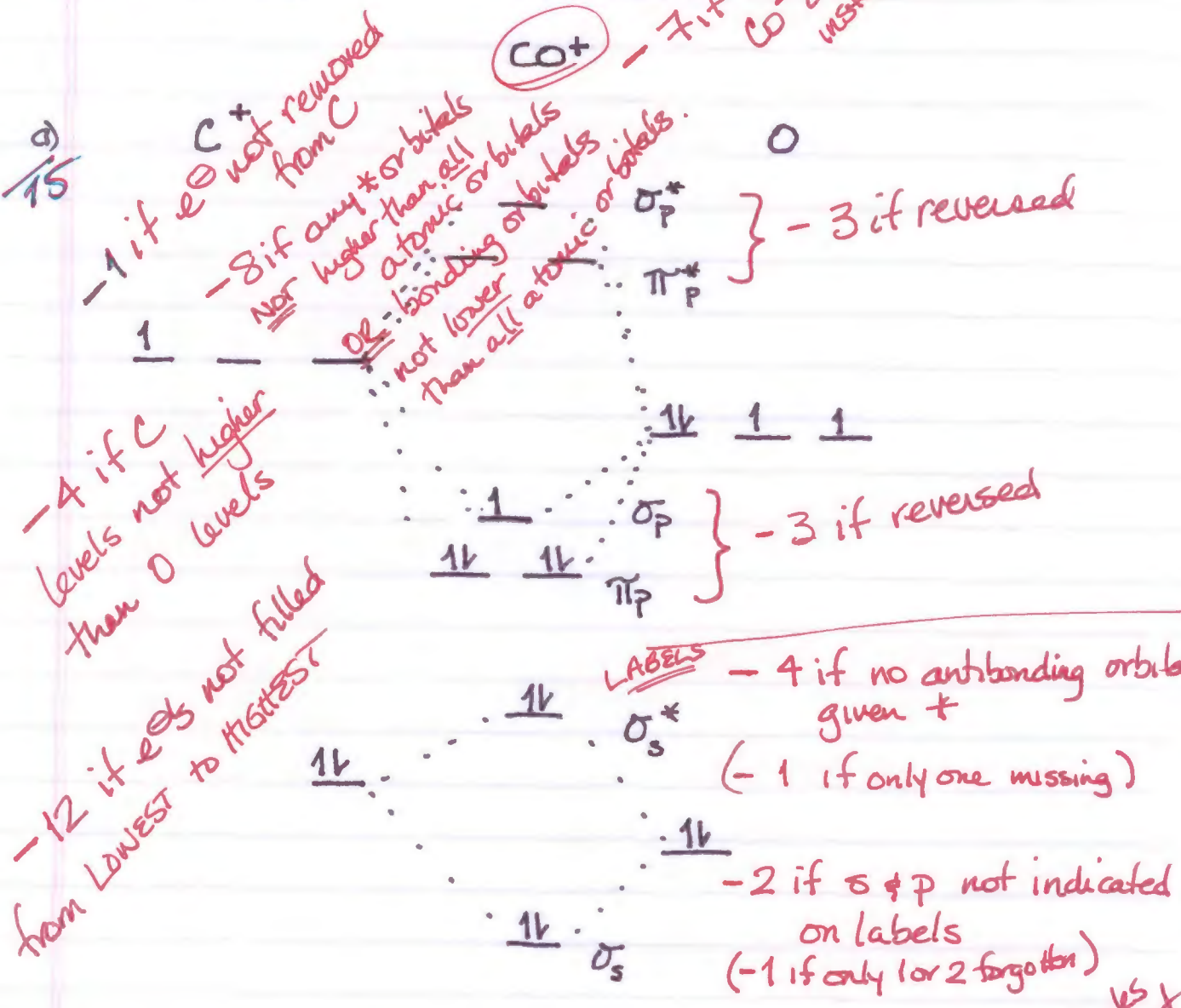
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CO+

- 7 if CO or CO⁻ done instead.

Q6.
20

a)
15



2 b) Bond order : $\frac{7-2}{2} = 5/2$ or $2\frac{1}{2}$ or 2.5

2 c) 1 unpaired e⁻ ⇒ PARAMAGNETIC

1 d) Larger bond order or Shorter bond.

Full marks if consistent