1 **C**
Either calculate or do by elimination. Answer can't be **D**. Can't be **B** cos you don't have equal proportions of the two isotopes. Either **A** or **C**. But there are more of mass number 11, so 10.8 is correct.

2 **B**
$n(N_xO_y) = \frac{120}{24000} = 5 \times 10^{-3}$ mol; $M_r = \frac{0.23}{5\times10^{-3}} = 46$

3 **A**
B is wrong because the atom consists of protons, electrons, etc.
C is wrong because of the existence of isotopes.

4 **A**
Electrons are negatively charged; neutrons neutral and protons positively charged.

5 **C**
$[:C\equiv N:]^-$

6 **D**
The H of OH is hydrogen-bonded to lone pair on O of CO_2.

7 **C**
This is a two-step reaction with an intermediate, so either **C** or **D**. But activation energy for first step is 50 kJ mol^{-1}, so **C**.

8 **B**
ΔH_f refers to one mole of Fe_2O_3 . So $-\frac{1648}{2} = -824$

9 **A**
Reversing equation for reaction I, i.e.
reaction I(a): $2X_2Y(g) \rightleftharpoons 2X_2(g) + Y_2(g)$
=> K_c for I(a) = $\frac{1}{2}$ (reciprocal of old K_c)
Dividing equation I(a) throughout by 2 gives reaction II => square root of K_c

10 **C**
Answer obviously can't be **A**. Decrease in *T* => area *N* decrease and area *L* increase.

11 **B**
Two effects: (a) rate of reaction for **Y** is slower; (b) vol of O_2 is more.
A, **C** and **D** are wrong because can't account for (b). **B** dilutes original solution, so rate is slower; it also increases amount of H_2O_2 => vol of O_2 is more

12 **B**
Not **C** because $AlCl_3$ is covalent.

13 **D**
N uses its lone pair to form dative bond to Al in $(CH_3)_3NAlH_3$. Hence Al has four bond pairs => tetrahedral

14 **B**
Reaction 1 is thermal decomposition of carbonates. Recall in O Level, lime kiln must be continuously heated. Reaction 2 is very exothermic; recall when you were in Sec 1 on a sunny morning, your teacher who was wearing a floral print dress showed you this spectacular reaction by adding water drop by drop to lime (CaO) in a watch-glass. But you were all busy counting the number of flowers on her dress, that's why you can't remember a thing about the demo.

15 **C**
To cut a long story short, the question is: find change in o.s. of Cl for $Cl_2 \rightarrow ClO^-$.
Answer is then $0 \rightarrow +1$. If you don't know how to calc the o.s. of Cl in ClO^-, the name chlorate(I) ion is a big clue.

16 **C**
The enthalpy change of formation tells us the stability of the compound (HX) relative to the constituent elements (H_2 and X_2). So clearly HCl is much more stable (more exothermic ΔH_f). We can express the ΔH in terms of bond energies.
$\Delta H = 2 \times E(H–X) – E(H–H) – E(X–X)$
For X = Cl, $\Delta H = 2 \times 431 – 436 – 244$
vs for X = I, $\Delta H = 2 \times 299 – 436 – 151$
So **most** important factor is *E*(H–X) as it is multiplied by 2 and difference greater.

17 **C**
Excess air => CO_2 formed, so either **C** or **D**. If burn elemental S in air => SO_2 not SO_3. So same thing happens for sulfur compounds.

18 **D**
Gas is NH_3 => NH_4^+ present => nitrate is NH_4NO_3.

19 **C**
The 4 Cs in middle of the six C chain.

20 **D**
Cl substituted with F. So similar to RX substitution. Hence NS.

21 **D**
Substitute H on CH_3 with Cl, so FRS.

22 **A**
Electrophilic addition

23 **D**
Note C=C bond in $C_2H_2Cl_2$.

24 **D**
Hydrolysis of RX is NS.

25 **C**
X must be KCN in C_2H_5OH, so either **B** or **C**. **B** is alkaline hydrolysis, giving carboxylate ion. So use acidic hydrolysis **C** to get carboxylic acid.

26 **C**
Chiral carbon => 4 diff groups around a C. Does not react with MnO_4^-/H^+ => 3° alcohol. Make the C with OH group chiral and 3°. Attach three different alkyl groups (methyl, ethyl and propyl). Total C = 1 + 2 + 3 + 1 (don't forget the chiral C!) = 7.

27 **B**
Oxidation of aldehyde and 2° alcohol.

28 **C**
Both **B** (ketone) and **C** (aldehyde) react with 2,4-DNPH to give orange ppt but only the aldehyde can be oxidised by H^+/MnO_4^-.

29 **C**
Carbonyl compound undergoes nucleophilic addition.

30 **B**
$CH_3CH_2CO_2CH_3$: the first 3 C atoms in the ester comes from propanoic acid.

31 **A**
No. of protons in Tc = 43 (how long did it take you to find this element in the Periodic Table?).
But option **1** is tricky: "13 *more* neutrons than protons". No. of neutrons = 99 – 43 = 56. So it is correct!

32 **C**
Brass: only metallic; it is a mixture of Cu and Zn *metals*.
graphite: covalent + vdw;
ice: covalent + H bond

33 **B**
Option **1** is correct since S(-2) → S(+4).
Option **2** is correct. H_2S again oxidised; SO_2 is OA here.
Option **3** is wrong because SO_2 generated in reaction 1 but used up in reaction 2.

34 **D**
If Hg level rises in right limb => pressure in **R** greater than in **S**. We are looking for a system in **R** which is at greater *p* when *T* increases.
Option **1** is therefore correct since increase in *T* favours forward endothermic reaction and leads to increase in no. of gas particles.
Options **2** and **3** do not lead to a change in no. of gas particles in **R**.

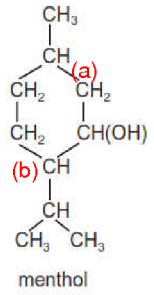
35 **D**
Option **2** is wrong since SiO_2 is also insoluble in water.
Option **3** is wrong because +5 in P, etc.

36 **D**
Option **1** is correct. All Group VII elements are diatomic molecules. The dissociation $X_2 \rightarrow 2X(g)$ involves breaking of the X–X covalent bond and so should take place more readily for astatine as At–At bond is weaker.

37 **A**
Option **1** is correct. You can check that the reaction is endothermic using bond energies.
Option **2** is correct. Strong covalent bonds need to be broken, resulting in a high E_a.
Option **3** is correct. The N≡N bond energy is very high (994 kJ mol^{-1}).

38 **A**
Option **1** Elimination to form alkene.
Option **2** FRS if replace any of the H with e.g. Cl.
Option **3** NS if replace Br with OH, CN, etc.

39 **C**
Option **1** is wrong. There are 3 chiral carbons.
Option **2** is correct as H can be eliminated from either C(a) or C(b) (see diagram below).



menthol

Option **3** is correct as the 2° alcohol can be oxidised.

40 **D**
Only aqueous acid in option **1** can hydrolyse ester.