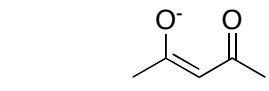
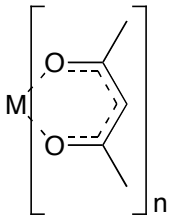
3. Many transition metals have characteristic isotope patterns. Electron ionization (EI) mass spectra are shown for five transition metal acetylacetonate (acac) complexes. The complexes are of the general formula $M(acac)_n$ and the general structure shown below. The complexes all contain one metal atom and two or three acetylacetonate ligands.



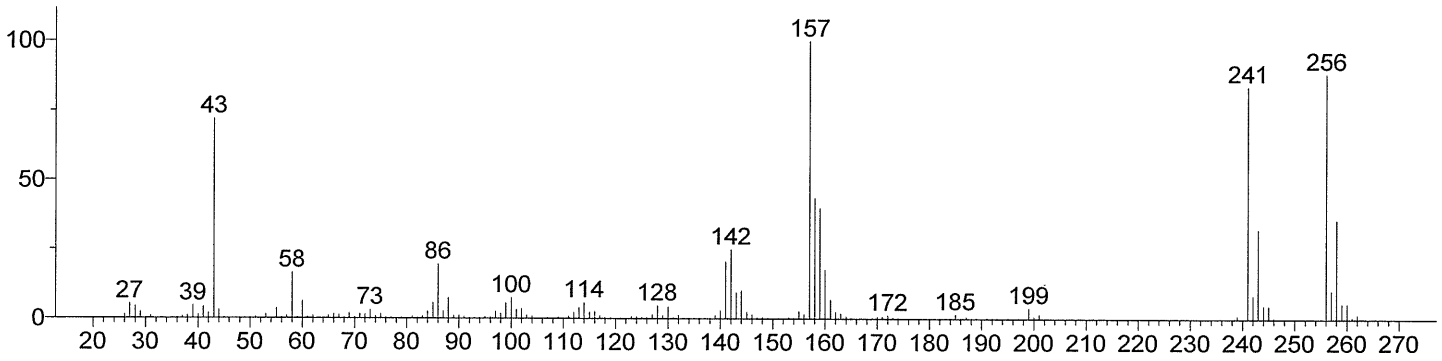
the acetyacetonate (acac) ligand



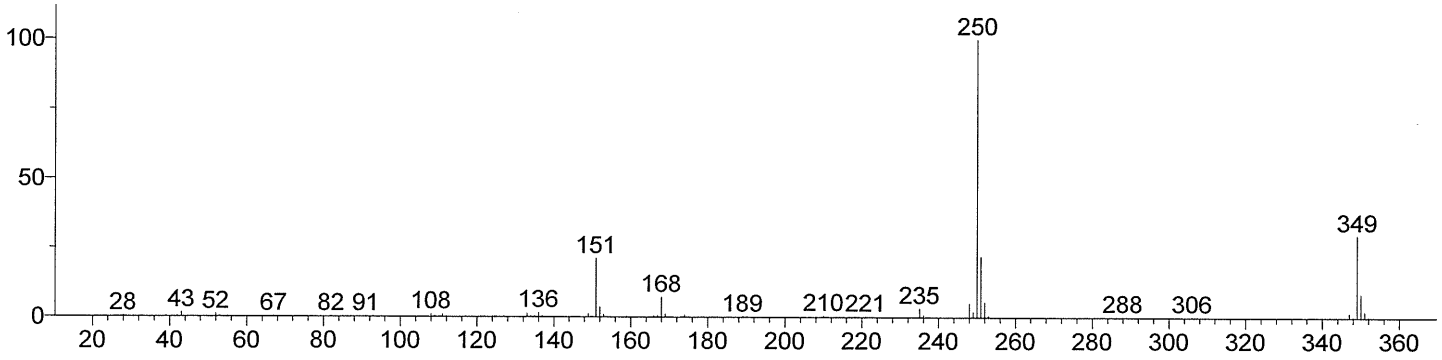
$M(acac)_n$

Using the table of major isotopes and relative isotopic abundances of common transition metals provided at the end of this problem, identify the transition metal associated with mass spectra A-E.

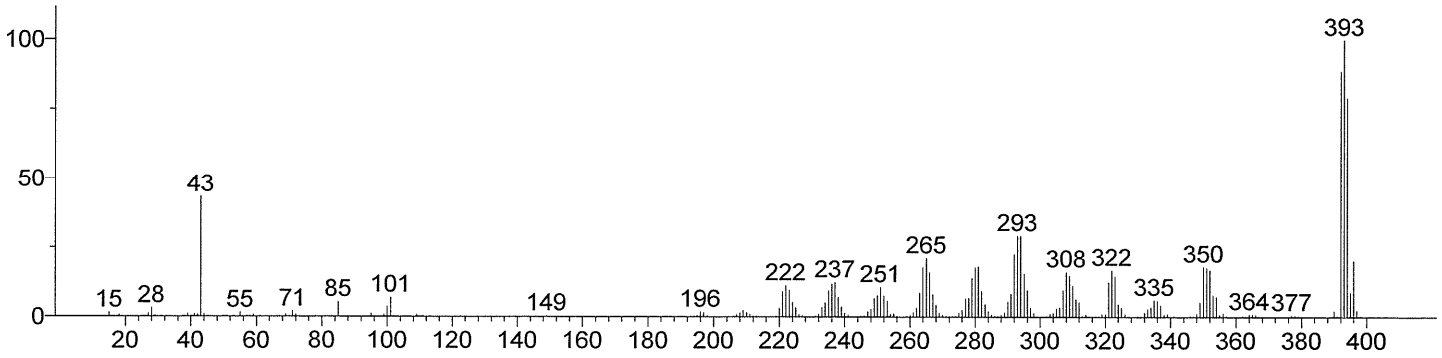
Spectrum A. Identify the transition metal: _____



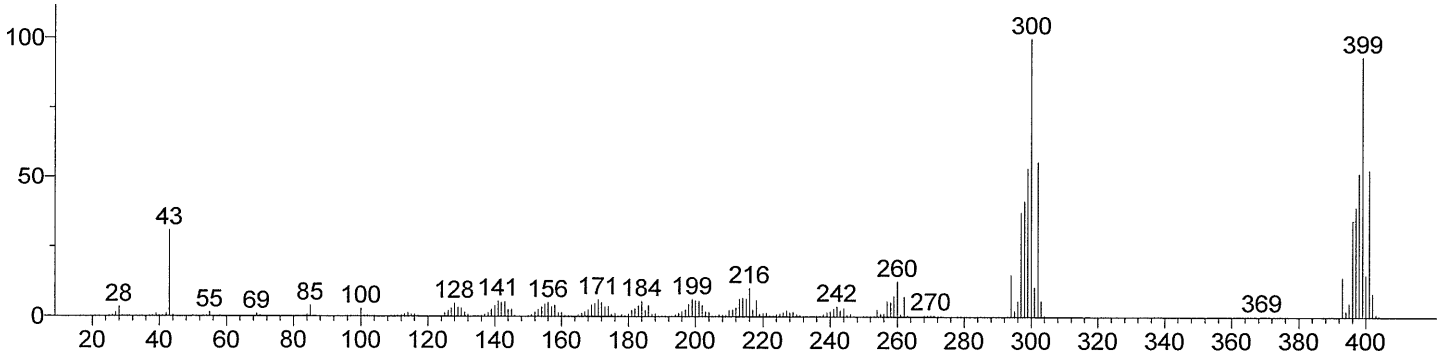
Spectrum B. Identify the transition metal: _____



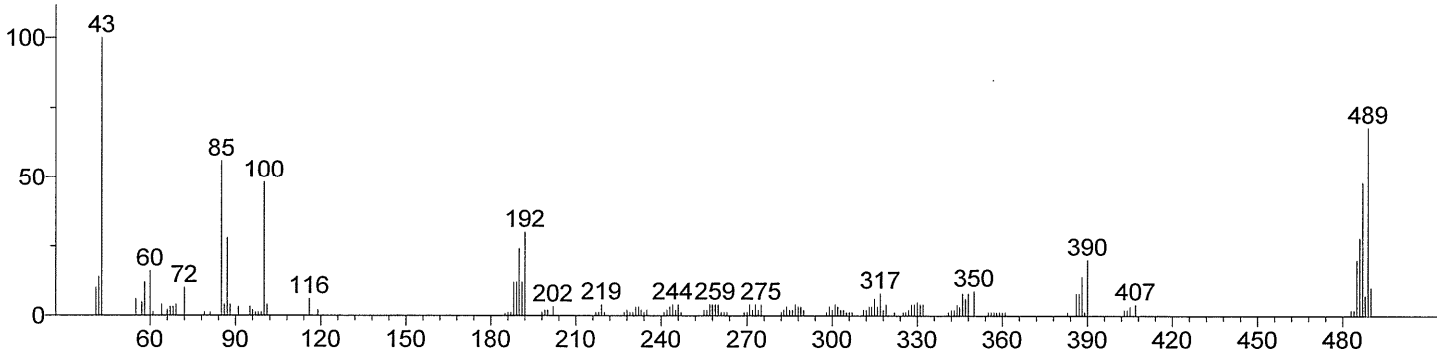
Spectrum C. Identify the transition metal: _____



Spectrum D. Identify the transition metal: _____



Spectrum E. Identify the transition metal: _____



Major isotopes and relative isotopic abundances of common transition metals

Element	Symbol	Mass	Relative intensity
Titanium	^{46}Ti	45.9526	11.2
	^{47}Ti	46.9518	10.1
	^{48}Ti	47.9479	100
	^{49}Ti	48.9479	7.3
	^{50}Ti	49.9448	7.0
Vanadium	^{51}V	50.9440	100
Chromium	^{50}Cr	49.9461	5.2
	^{52}Cr	51.9405	100
	^{53}Cr	52.9407	11.3
	^{54}Cr	53.9389	2.8
Manganese	^{55}Mn	54.9381	100
Iron	^{54}Fe	53.9396	6.4
	^{56}Fe	55.9349	100
	^{57}Fe	56.9354	2.3
Cobalt	^{59}Co	58.9332	100
Nickel	^{58}Ni	57.9353	100
	^{60}Ni	59.9308	38.5
	^{61}Ni	60.9311	1.7
	^{62}Ni	61.9283	5.3
	^{64}Ni	63.9280	1.4
Copper	^{63}Cu	62.9296	100
	^{65}Cu	64.9278	44.6
Zinc	^{64}Zn	63.9291	100
	^{66}Zn	65.9260	57.4
	^{67}Zn	66.9271	8.4
	^{68}Zn	67.9248	38.6
	^{70}Zn	69.9253	1.3
Molybdenum	^{92}Mo	91.9068	61.5
	^{94}Mo	93.9051	38.3
	^{95}Mo	94.9058	66.0
	^{96}Mo	95.9047	69.1
	^{97}Mo	96.9060	39.6
	^{98}Mo	97.9054	100
	^{100}Mo	99.9075	39.9
Ruthenium	^{96}Ru	95.9076	17.6
	^{98}Ru	97.9053	5.9
	^{99}Ru	98.9059	40.4
	^{100}Ru	99.9042	39.9
	^{101}Ru	100.9052	54.1
	^{102}Ru	101.9044	100
	^{104}Ru	103.9054	59.0

Element	Symbol	Mass	Relative intensity
Palladium	^{102}Pd	101.9056	3.7
	^{104}Pd	103.9041	40.8
	^{105}Pd	104.9051	81.7
	^{106}Pd	105.9035	100
	^{108}Pd	107.9039	96.8
	^{110}Pd	109.9052	42.9
Silver	^{107}Ag	106.9051	100
	^{109}Ag	108.9048	92.9
Cadmium	^{106}Cd	105.9065	4.4
	^{108}Cd	107.9042	3.1
	^{110}Cd	109.9030	43.5
	^{111}Cd	110.9042	44.6
	^{112}Cd	111.9028	84.0
	^{113}Cd	112.9044	42.5
	^{114}Cd	103.9034	100
	^{116}Cd	115.9048	26.0
Rhenium	^{185}Re	184.9530	59.8
	^{187}Re	186.9558	100
Osmium	^{186}Os	185.9538	3.9
	^{187}Os	186.9557	4.8
	^{188}Os	187.9558	32.5
	^{189}Os	188.9582	39.6
	^{190}Os	189.9584	64.4
	^{192}Os	191.9615	100
Platinum	^{192}Pt	191.9610	2.3
	^{194}Pt	193.9627	97.4
	^{195}Pt	194.9648	100
	^{196}Pt	195.9649	74.6
	^{198}Pt	197.9679	21.2
Gold	^{197}Au	196.9666	100
Mercury	^{198}Hg	197.9668	33.4
	^{199}Hg	198.9683	56.5
	^{200}Hg	199.9683	77.4
	^{201}Hg	200.9703	44.1
	^{202}Hg	201.9706	100
	^{204}Hg	203.9735	23.0