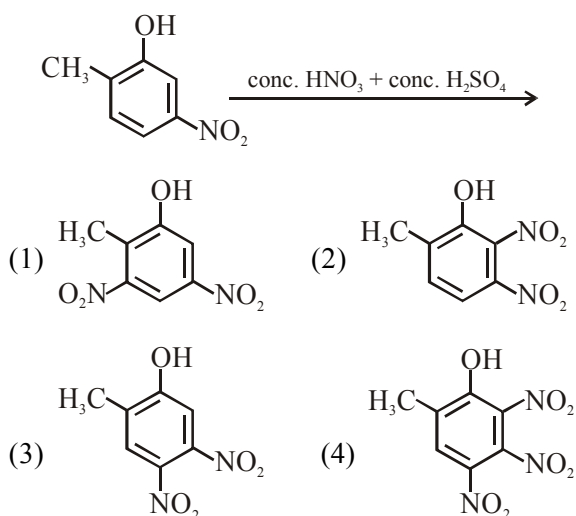


**FINAL JEE–MAIN EXAMINATION – SEPTEMBER, 2020**  
(Held On Wednesday 02<sup>nd</sup> SEPTEMBER, 2020) TIME : 3 PM to 6 PM

**CHEMISTRY**

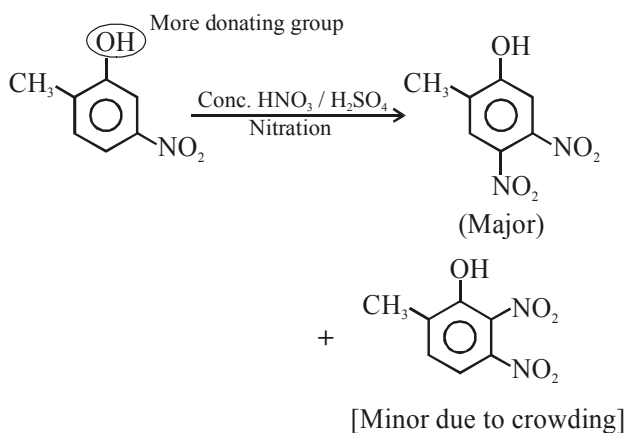
**TEST PAPER WITH ANSWER & SOLUTIONS**

1. The major product of the following reaction is:



**Official Ans. by NTA (3)**

**Sol.**



2. If you spill a chemical toilet cleaning liquid on your hand, your first aid would be :

- (1) aqueous  $\text{NH}_3$       (2) vinegar  
 (3) aqueous  $\text{NaHCO}_3$       (4) aqueous  $\text{NaOH}$

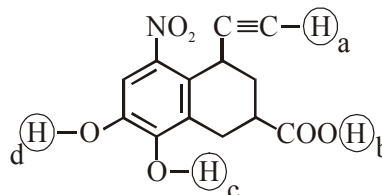
**Official Ans. by NTA (3)**

**Sol.** Toilet cleaning liquid has about 10.5% w/v  $\text{HCl}$ ; to neutralise its affect aqueous  $\text{NaHCO}_3$  is used while  $\text{NaOH}$  is avoid for this purpose because its highly corosive in nature and can burn body.

**Aliter :**

Dil  $\text{HCl}$  is generally used as toilet cleaner  
 $\therefore \text{NaHCO}_3$  is used to neutralize it

3. Arrange the following labelled hydrogens in decreasing order of acidity :



- (1)  $b > c > d > a$   
 (2)  $c > b > a > d$   
 (3)  $b > a > c > d$   
 (4)  $c > b > d > a$

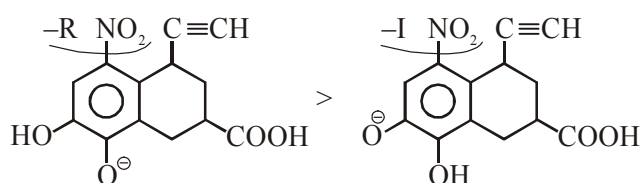
**Official Ans. by NTA (1)**

**Sol.** Acidic strength order :



Reason :  $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-$  stable by equivalent resonance.

Stable :



So answer is  $b > c > d > a$ .

4. Cast iron is used for the manufacture of :

- (1) wrought iron and pig iron  
 (2) wrought iron and steel  
 (3) wrought iron, pig iron and steel  
 (4) pig iron, scrap iron and steel

**Official Ans. by NTA (2)**

**Sol.** Cast iron is used for manufacturing of wrought iron and steel.

5. Two compounds A and B with same molecular formula ( $C_3H_6O$ ) undergo Grignard's reaction with methylmagnesium bromide to give products C and D. products C and D show following chemical tests.

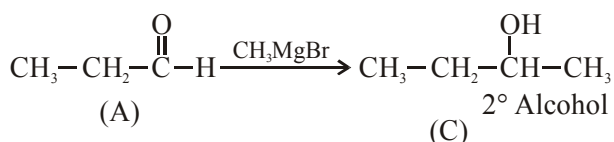
Test	C	D
Ceric ammonium nitrate Test	Positive	Positive
Lucas Test	Turbidity obtained after five minutes	Turbidity obtained immediately
Iodoform Test	Positive	Negative

C and D respectively are :

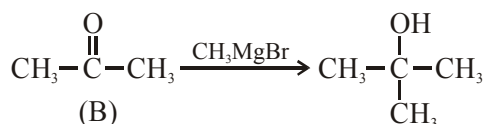
- (1)  $C = H_3C - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - OH$  ;  
 $D = H_3C - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$
- (2)  $C = H_3C - CH_2 - CH_2 - CH_2 - OH$  ;  
 $D = H_3C - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - OH$
- (3)  $C = H_3C - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$  ;  
 $D = H_3C - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - OH$
- (4)  $C = H_3C - CH_2 - CH_2 - CH_2 - OH$  ;  
 $D = H_3C - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

**Official Ans. by NTA (3)**

**Sol.**



CAN test for alcohol : ✓  
 Iodoform test : ✓



CAN test for alcohol : ✓  
 Lucas test : Immediately  
 Iodoform test : ✗

6. The shape/structure of  $[XeF_5]^-$  and  $XeO_3F_2$ , respectively, are :

- (1) pentagonal planar and trigonal bipyramidal  
 (2) trigonal bipyramidal and pentagonal planar  
 (3) octahedral and square pyramidal  
 (4) trigonal bipyramidal and trigonal bipyramidal

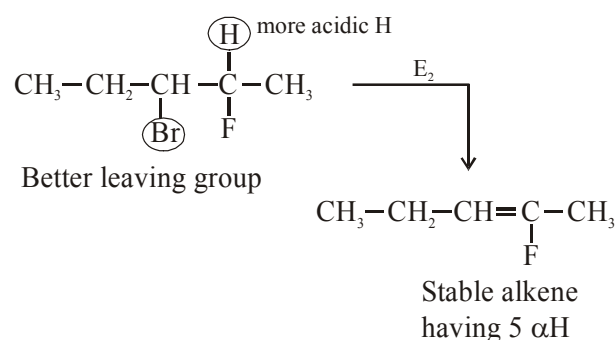
**Official Ans. by NTA (1)**

7. The major product obtained from  $E_2$ -elimination of 3-bromo-2-fluoropentane is:

- (1)  $CH_3CH_2 - \overset{\overset{Br}{|}}{CH} - CH = CH_2$   
 (2)  $CH_3 - CH_2 - \overset{\overset{Br}{|}}{C} = CH - CH_3$   
 (3)  $CH_3 - CH = CH - \overset{\overset{F}{|}}{CH} - CH_3$   
 (4)  $CH_3CH_2CH = \underset{\underset{CH_3}{|}}{C} - F$

**Official Ans. by NTA (4)**

**Sol.**



8. Three elements X, Y and Z are in the 3<sup>rd</sup> period of the periodic table. The oxides of X, Y and Z, respectively, are basic, amphoteric and acidic. The correct order of the atomic numbers of X, Y and Z is :

- (1)  $Z < Y < X$  (2)  $X < Z < Y$   
 (3)  $X < Y < Z$  (4)  $Y < X < Z$

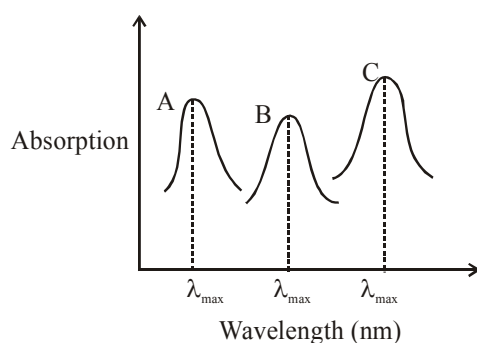
**Official Ans. by NTA (3)**

**Sol.** When we are moving from left to right in a periodic table acidic character of oxides increases (as well as atomic number of atom increases)  
 $\therefore X < Y < Z$  (acidic character)  
 $X < Y < Z$  (atomic number)

9. The number of subshells associated with  $n = 4$  and  $m = -2$  quantum numbers is :  
 (1) 4 (2) 8 (3) 16 (4) 2

**Official Ans. by NTA (4)**

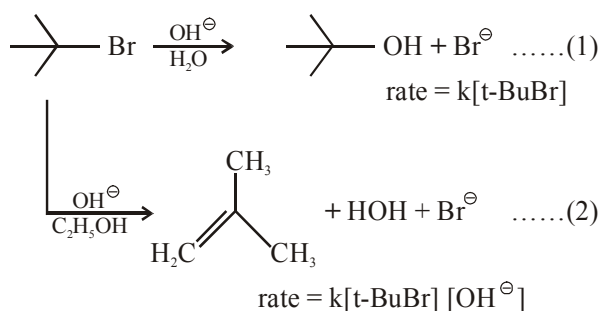
10. Simplified absorption spectra of three complexes ((i), (ii) and (iii)) of  $M^{n+}$  ion are provided below; their  $\lambda_{\max}$  values are marked as A, B and C respectively. The correct match between the complexes and their  $\lambda_{\max}$  values is :



- (i)  $[M(NCS)_6]^{(-6+n)}$  (ii)  $[MF_6]^{(-6+n)}$   
 (iii)  $[M(NH_3)_6]^{n+}$   
 (1) A-(ii), B-(i), C-(iii) (2) A-(iii), B-(i), C-(ii)  
 (3) A-(ii), B-(iii), C-(i) (4) A-(i), B-(ii), C-(iii)

**Official Ans. by NTA (2)**

11. Consider the reaction sequence given below :



Which of the following statements is true :

- (1) Changing the concentration of base will have no effect on reaction (1)  
 (2) Changing the concentration of base will have no effect on reaction (2)  
 (3) Changing the base from  $\text{OH}^\ominus$  to  $^\ominus\text{OR}$  will have no effect on reaction (2)  
 (4) Doubling the concentration of base will double the rate of both the reactions.

**Official Ans. by NTA (1)**

**Sol.** Reaction 1 :  $\text{SN}_1$

Reaction 2 :  $\text{E}_2$

$\text{SN}_1$  is independent of concentration of nucleophile/base

12. The results given in the below table were obtained during kinetic studies of the following reaction:



Experiment	[A]/molL <sup>-1</sup>	[B]/molL <sup>-1</sup>	Initial rate/molL <sup>-1</sup> min <sup>-1</sup>
I	0.1	0.1	$6.00 \times 10^{-3}$
II	0.1	0.2	$2.40 \times 10^{-2}$
III	0.2	0.1	$1.20 \times 10^{-2}$
IV	X	0.2	$7.20 \times 10^{-2}$
V	0.3	Y	$2.88 \times 10^{-1}$

X and Y in the given table are respectively :

- (1) 0.3, 0.4 (2) 0.4, 0.3  
 (3) 0.4, 0.4 (4) 0.3, 0.3

**Official Ans. by NTA (1)**

**Sol.** From rate law

$$r = -\frac{1}{2} \frac{d[\text{A}]}{dt} = -\frac{d[\text{B}]}{dt}$$

$$= K[\text{A}]^x [\text{B}]^y$$

$$6 \times 10^{-3} = K(0.1)^x (0.1)^y \quad \text{.....(1)}$$

$$2.4 \times 10^{-2} = K(0.1)^x (0.2)^y \quad \text{.....(2)}$$

$$1.2 \times 10^{-2} = K(0.2)^x (0.1)^y \quad \text{.....(3)}$$

$$(3) \div (1) \Rightarrow x = 1$$

$$(2) \div (3) \Rightarrow x = 2$$

So, other with respect to A = 1

Order with respect to B = 2

$$(4) \div (3)$$

$$\left(\frac{x}{0.2}\right) \times \left(\frac{0.2}{0.1}\right)^2 = \frac{7.2 \times 10^{-2}}{1.2 \times 10^{-2}}$$

$$x = \frac{6 \times 0.2}{4}$$

$$x = 0.3 \text{ M}$$

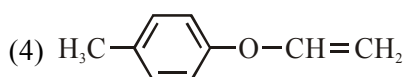
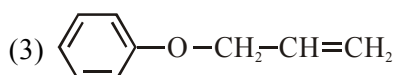
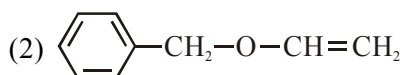
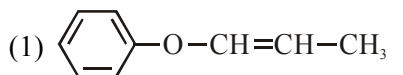
$$(5) \div (4)$$

$$\left(\frac{y}{0.2}\right)^2 = \frac{2.88 \times 10^{-1}}{7.2 \times 10^{-2}}$$

$$y^2 = 4 \times 0.2^2$$

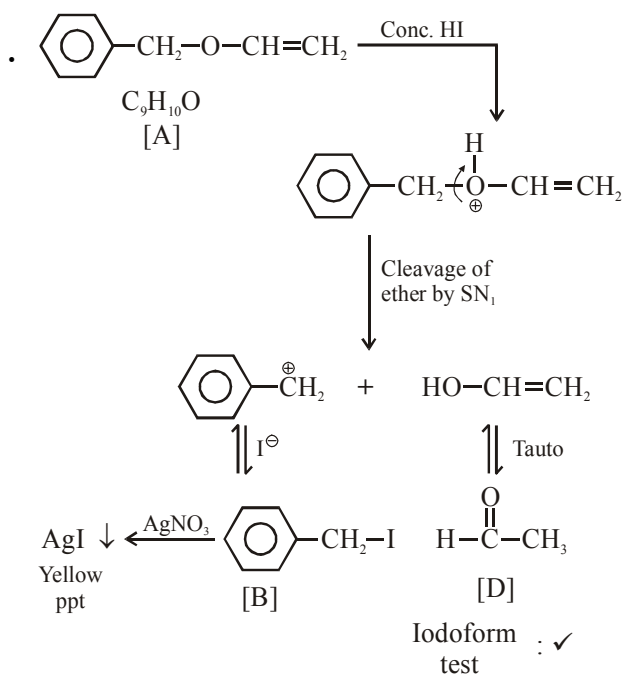
$$y = 0.4 \text{ M}$$

13. An organic compound 'A' ( $C_9H_{10}O$ ) when treated with conc. HI undergoes cleavage to yield compounds 'B' and 'C'. 'B' gives yellow precipitate with  $AgNO_3$  whereas 'C' tautomerizes to 'D'. 'D' gives positive iodoform test. 'A' could be :



Official Ans. by NTA (2)

Sol



14. The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following processes can explain this ?
- (1) Diffusion (2) Dialysis  
(3) Osmosis (4) Reverse osmosis

Official Ans. by NTA (3)

Sol. Raw mango shrink in salt solution due to net transfer of water molecules from mango to salt solution due to phenomenon of osmosis.

15. Two elements A and B have similar chemical properties. They don't form solid hydrogencarbonates, but react with nitrogen to form nitrides. A and B, respectively, are :

- (1) Na and C (2) Li and Mg  
(3) Cs and Ba (4) Na and Rb

Official Ans. by NTA (2)

16. The one that is not expected to show isomerism is :

- (1)  $[Ni(NH_3)_4(H_2O)_2]^{2+}$  (2)  $[Ni(NH_3)_2Cl_2]$   
(3)  $[Pt(NH_3)_2Cl_2]$  (4)  $[Ni(en)_3]^{2+}$

Official Ans. by NTA (2)

17. Amongst the following statements regarding adsorption, those that are valid are :

- (a)  $\Delta H$  becomes less negative as adsorption proceeds.  
(b) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.  
(c) On adsorption, the residual force acting along the surface of the adsorbent increases.  
(d) With increase in temperature, the equilibrium concentration of adsorbate increases.

- (1) (b) and (c) (2) (a) and (b)  
(3) (d) and (a) (4) (c) and (d)

Official Ans. by NTA (2)

- Sol. (a) Since adsorption is exothermic process, as adsorption proceeds number of active sites present over adsorbent decreases, so less heat is evolved.  
(b) Since  $NH_3$  has higher force of attraction on adsorbent due to its polar nature (high value of 'a').  
(c) As the adsorption increases, residual forces over surface decreases.  
(d) Since process is exothermic, on increasing temperature it shift to backward direction, so concentration of adsorbate particle decreases.

18. Match the type of interaction in Column A with the distance dependence of their interaction energy in Column B :

A	B
(I) iron - ion	(a) $\frac{1}{r}$
(II) dipole - dipole	(b) $\frac{1}{r^2}$
(III) London dispersion	(c) $\frac{1}{r^3}$
	(d) $\frac{1}{r^6}$

- (1) (I)-(a), (II)-(b), (III)-(c)  
 (2) (I)-(a), (II)-(c), (III)-(d)  
 (3) (I)-(a), (II)-(b), (III)-(d)  
 (4) (I)-(b), (II)-(d), (III)-(c)

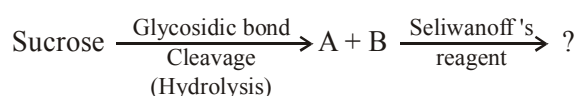
**Official Ans. by NTA (3)**

**Official Ans. by ALLEN (2)**

- Sol.** Type of interaction  $\propto$  Interaction Energy

ion - ion	$\frac{1}{r}$
dipole - dipole	$\frac{1}{r^3}$
London dispersion	$\frac{1}{r^6}$

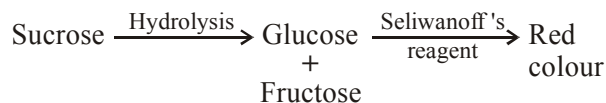
19. The correct observation in the following reactions is :



- (1) Formation of blue colour  
 (2) Formation of violet colour  
 (3) Formation of red colour  
 (4) Gives no colour

**Official Ans. by NTA (3)**

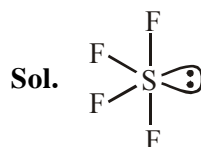
- Sol.** Seliwanoff's test is used to distinguish between aldose and ketone sugars; when added to a solution containing ketose, red colour is formed rapidly.



20. The molecular geometry of  $\text{SF}_6$  is octahedral. What is the geometry of  $\text{SF}_4$  (including lone pair(s) of electrons, if any) ?

- (1) Trigonal bipyramidal  
 (2) Square planar  
 (3) Tetrahedral  
 (4) Pyramidal

**Official Ans. by NTA (1)**



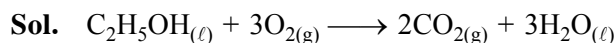
4σ bonds + 1 lone pair

∴ Shape (including lone pair of electrons) is Trigonal bipyramidal

21. The heat of combustion of ethanol into carbon dioxides and water is -327 kcal at constant pressure. The heat evolved (in cal) at constant volume and 27°C (if all gases behave ideally) is ( $R = 2 \text{ cal mol}^{-1} \text{ K}^{-1}$ )

**Official Ans. by NTA (-326400.00)**

**Official Ans. by ALLEN (326400.00)**



$$\Delta n_g = 2 - 3 = -1$$

$$\Delta_c H = \Delta_c U + (\Delta n_g) RT$$

$$\Delta_c H = \Delta_c U - RT$$

$$\Delta_c U = \Delta_c H + RT$$

$$= -327 \times 10^3 + 2 \times 300$$

$$= -326400 \text{ cal.}$$

∴ Heat evolved

$$= 326400 \text{ cal.}$$

22. For the disproportionation reaction  
 $2\text{Cu}^+(\text{aq}) \rightleftharpoons \text{Cu}(\text{s}) + \text{Cu}^{2+}(\text{aq})$  at 298 K,  
 $\ln K$  (where  $K$  is the equilibrium constant)  
 is  $\underline{\hspace{2cm}} \times 10^{-1}$ .

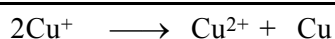
Given

$$(E_{\text{Cu}^{2+}/\text{Cu}^+}^0 = 0.16\text{V}$$

$$E_{\text{Cu}^+/\text{Cu}}^0 = 0.52\text{V}$$

$$\frac{RT}{F} = 0.025)$$

**Official Ans. by NTA (144.00)**



$$E_{\text{cell}}^0 = E_{\text{Cu}^+/\text{Cu}}^0 - E_{\text{Cu}^{2+}/\text{Cu}^+}^0$$

$$= 0.52 - 0.16$$

$$= 0.36 \text{ V}$$

At equilibrium  $\rightarrow E_{\text{cell}} = 0$

$$E_{\text{cell}}^0 = \frac{RT}{nF} \ln K$$

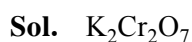
$$\ln K = \frac{E_{\text{cell}}^0 \times nF}{RT}$$

$$\ln K = \frac{0.36 \times 1}{0.025}$$

$$= 14.4 = 144 \times 10^{-1}$$

23. The oxidation states of transition metal atoms in  $\text{K}_2\text{Cr}_2\text{O}_7$ ,  $\text{KMnO}_4$  and  $\text{K}_2\text{FeO}_4$ , respectively, are  $x$ ,  $y$  and  $z$ . The sum of  $x$ ,  $y$  and  $z$  is  $\underline{\hspace{2cm}}$ .

**Official Ans. by NTA (19.00)**



$$2(+1) + 2X + 7(-2) = 0$$

$$X = 6$$

Transition metal chromium is present in +6 oxidation state.

In  $\text{KMnO}_4$  transition metal molar mass is present in +7 oxidation state

In  $\text{K}_2\text{FeO}_4$  transition metal Fe is present in +6 oxidation state

$$\text{So, } x = 6$$

$$y = 7$$

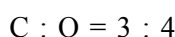
$$z = 6$$

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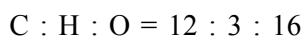

$$x + y + z = 19$$

24. The ratio of the mass percentages of 'C & H' and 'C & O' of a saturated acyclic organic compound 'X' are 4 : 1 and 3 : 4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is  $\underline{\hspace{2cm}}$ .

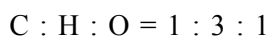
**Official Ans. by NTA (5.00)**



Mass ratio



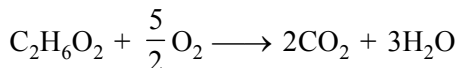
Mole ratio



Empirical formula =  $\text{CH}_3\text{O}$

Molecular formula =  $\text{C}_2\text{H}_6\text{O}_2$

(saturated acyclic organic compound)



Moles of  $\text{O}_2$  required = 5 moles

25. The work function of sodium metal is  $4.41 \times 10^{-19} \text{ J}$ . If the photons of wavelength 300 nm are incident on the metal, the kinetic energy of the ejected electrons will be ( $h = 6.63 \times 10^{-34} \text{ Js}$ ;  $c = 3 \times 10^8 \text{ m/s}$ )  $\underline{\hspace{2cm}} \times 10^{-21} \text{ J}$ .

**Official Ans. by NTA (222.00)**

**Sol.**  $E = W + K \cdot E_{\text{max}}$

$$K \cdot E_{\text{max}} = E - W$$

$$= \frac{hc}{\lambda} - 4.41 \times 10^{-19}$$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9}} - 4.41 \times 10^{-19}$$

$$= 2.22 \times 10^{-19} \text{ J}$$

$$= 222 \times 10^{-21} \text{ J}$$